[ESTABLISHED 1832]
THE OLDEST RAILROAD JOURNAL IN THE WORLD

AMERICAN ENGINEER AND RAILROAD JOURNAL.

PUBLISHED MONTHLY
BY
R. M. VAN ARSDALE, INC.
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J. S. BONSALL, Vice-President and General Manager

F. H. THOMPSON, Advertising Manager.

Editors:
E. A. AVERILL. R. H. ROGERS

NOVEMBER, 1910

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Mr. Rogers' experience, combining as it does several years of newspaper work, together with a long and diversified service in the motive power departments of various railways, is one that particularly well fits him for this position. He is a graduate of the Baltimore Polytechnic Institute and entered railway service as machinist apprentice on the Baltimore & Ohio Railroad, following which he was a machinist for three years, and in 1895 was made general piece work inspector of that system. His next promotion was to roundhouse foreman at the Pittsburg terminal, which position he resigned to become shop foreman on the Mexican Central Railway at Mexico City. In 1898 he resigned from this position and for the next three years was on the staff of the Philadelphia *Times* and the *North American*. Leaving newspaper work to again take up railroading, he reentered the service of the Baltimore & Ohio as locomotive inspector at the Pittsburg and Richmond Works of the American Locomotive Co. Upon delivery of the locomotives being built he became assistant master mechanic at Mt. Clare, and later general foreman at Cumberland, Md. In February, 1905, he was appointed master mechanic of the N. Y. N. H. & H. Railroad, at South Boston, Mass., and on Jan. 1, 1908, he undertook the general and thorough inspection of the locomotive equipment of the Erie Railroad, upon the completion of which he spent several months in foreign countries studying locomotive practice.

MANUFACTURE OF PRESSED STEEL CAR SHAPES IN RAILROAD SHOPS

If a railroad owns a flange press, and the majority of the lager ones do include this appliance in the boiler shop layout, there is no valid reason, waiving, of course, the consideration of first costs, why it should not have additional employment in making pressed steel car shapes for renewals. A flange press in a repair shop is practically a dead tool; that is, so far as its full capacity in the output of boiler and firebox parts is concerned, and its use in the connection suggested should in no manner interference with its regular work.

In reviewing questions connected with pressed steel car repairs we have prominently in mind the success which has attended the efforts of the Philadelphia and Reading Railroad in thus extending the scope of the flange press to include car work. With about 14,000 cars on that line to maintain, one press easily keeps up with the requirements. It has not been found necessary to purchase a shape in nearly four years, and since the plan has become fully developed, the advantage, from an economical standpoint, is remarkable.

For instance, one shape, an end sill, was turned out at home for about $2.55, including labor and material, and which when formerly purchased cost $12.50. This is admitted to be a rather forcible, although a true illustration, but at all events there is no hesitancy in asserting that from 50 per cent. to 75 per cent. should be saved with the proper appliances, over the purchase price of any car shape.

It is appreciated that certain barriers interpose to the scheme, but still these are far from being insurmountable. The principal bugbear, of course, is the inevitable pattern shop delay, and the initial cost in getting out the patterns for the dies. With these items must also be reckoned the drafting room expense in connection with preparing the blue prints for the pattern makers. The cost incidental to machining the dies when received from the foundry is so comparatively insignificant that it need scarcely be considered. We believe that in view of the fact when the dies are finally out they will serve for practically all time, justifies the outlay, especially when the strong argument intrudes of the saving which can be made over buying the shapes from outside firms.

Our thought was that if not considered advisable to proceed on the elaborate scale which has characterized the Reading Railroad, it might be well to select, say ten shapes, which represent the most renewals. These are ordinarily end sill face plates, end sills, draft channels or sills, coupler horn braces, end sill reinforcing plates, end sill diaphragms, bottom follower guides, center stakes and joint stakes.

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Dies might be made for these parts at odd times, and in the order in which the general storekeepers books indicated as implying the greatest consumption. It is far better to proceed cautiously in this manner, and to the point, because experience

has shown conclusively that much time and money will be expended without definite results if it is attempted to put into use too many dies at once. When it is known, however, that the dies are out, and right, for any particular shape, it simply resolves into turning them off the press as fast as desired, or as the requirements warrant.

POST THE SHOP FORCE ON ENGINE FAILURES

It is unfortunate that shopmen, and particularly roundhouse men, do not have a more intimate knowledge of locomotive performance on the road. Very few of them seem to know what is giving the most trouble on their own division. Through an investigation recently conducted into a series of engine failures resulting from hot main pins on a prominent eastern railroad, the fact stood fully revealed that the large majority of the force were in ignorance that the trouble had virtually assumed the proportions of an epidemic, and one sufficient to delay several through passenger trains in a single day on one grand division of the system. They knew vaguely, of course, that main rod brasses were warming up, but could not appreciate the gravity of the situation because it was not presented to them in concrete form.

Therefore the thought suggests in this connection that to post a copy of the daily engine failure report, with such further explanatory matter as the master mechanic cared to make, on the shop bulletin board, would prove of great value in awakening interest, with a very good resultant effect. Entirely too much mystery enshrouds this report, as it is now generally handled. Probably this is because if it is bad the division motive power management is ashamed of it, and if blank, beyond a few expressions of felicitation in the office, it is quickly forgotten. At all events, it seldom leaves the office and the workmen are unaware whether the performance of their locomotives is good or bad.

It is felt that if the workmen knew the troubles which are occurring, local pride in their shop, and their natural desire to get ahead, would permit them to see at least that their part of the work is properly performed. It is as confidently believed that this report would be consulted and discussed every day, and through such subtle means as only the skilled workman can command, a permanent improvement would quickly ensue. Humanity is practically the same, whether in overalls or silk, in its desire to possess the confidence of superiors, and there is no better way to reach a workman than to make him really feel that he is no unimportant unit in the general scheme.

AN UNIVERSAL BOILER DISCUSSION

In all of the voluminous reports associated with the eighth session of the International Railway Congress there is probably embodied no more interesting subject to railroad mechanical supervision at large than the boiler question, which this particular session prominently featured. Fortunately it was decided long ago that this important matter should receive thorough analysis; an analysis which should include design, development, and last but not least, maintenance, and it is doubly fortunate that the reporters selected to represent the various countries of the world were men of conceded ability and world-wide reputation. In consequence, through their efforts a wealth of hitherto unsuspected material has been unearthed. In these reports we are taken into the inner councils of the designers; brought face to face with actual roundhouse conditions in foreign lands, and are presented with compelling statistics in support of views which might not otherwise appeal to us.

Actuated by these considerations, we regard the article in the current issue on the general subject of the locomotive boiler as of particular value at this time. While in a sense it is a compilation of the Railway Congress reports, nevertheless a certain latitude in drawing comparisons between foreign practices and our own practices is evident which carries a particular appeal, and which after careful study may result in some good.

It is, of course, unfortunate that the reporters, with few exceptions, did not give reasons for their views, and it is disappointing that the tenor of the reports in general does not convey much assurance that locomotive boiler development is progressive, but still the thoroughness with which the matter has been covered, and the tremendously important scope of the organization before which it was presented, conveys the hope of ultimate uniformity in design and methods, the lack of which is certainly painfully apparent at present.

NO ECONOMY IN CHEAP FUEL

In the committee report on fuel economy, presented at the recent convention of the Traveling Engineers' Association, one subdivision, viz., "whether it is more economical to buy cheap fuel of a low heat value, or a higher price fuel of a greater heat value," was of particular interest, as therein the committee, departing from the time-honored traditions of motive power propaganda, suggested that occasional engine failures were more economical than paying for good coal.

Following is the text of this portion of the report:

> The purchase price of coal has considerable to do with the kind of coal used. A number of the roads use coal that is mined on their own lines, and while this coal may not compare favorably with coal from nearby coal fields, the cost of transporting the other coal prohibits its use; but when the before mentioned conditions are not of great concern, we believe it is more economical for any railway company to use the cheapest grade of fuel they can get along with and keep the delays on the line down to a minimum.
>
> It is more economical to have an occasional engine failure on account of poor coal than it is to pay $75 to $100 a day more for coal on one division.
>
> On the average division from 600 to 1,000 tons of coal are consumed per day. If the price of coal is advanced 10 cents a ton, the cost is increased from $75 to $100 per day. Therefore it is a question of how many engine failures a road can afford to have for $75 to $100 a day, due to burning an inferior grade of coal.

This may be all right in the abstract, as an engine failure, at the moment, really costs nothing, but it is extremely doubtful if such conclusions will be viewed with favor by operating department heads. In every scheme of organization the efficiency of the motive power, and this means at least fifty per cent. of the efficiency of the service, is practically based on locomotive performance. Any failure of a locomotive to do its work on the road becomes at once the subject of an inquiry regarding the cause, which is followed with more persistence than is probably accorded to any other detail in the entire organization.

On many roads "poor coal" is no longer accepted as an explanation or as an excuse for low steam. In the majority of instances the coal is good, but if bad the fact should never be, and is not, admitted. This, of course, is to avoid the inevitable demoralization which must necessarily follow, not only among the engine crews, but in reflection throughout the entire mechanical department as well.

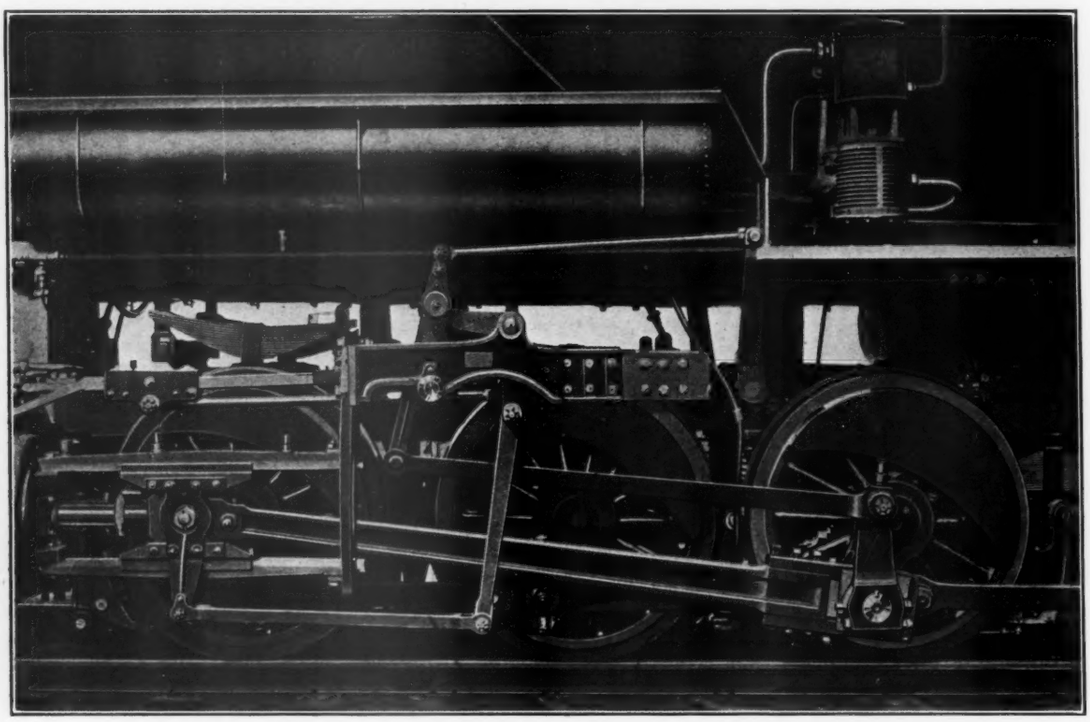
The work of a conscientious and skilful fireman might remain unaffected under such conditions, but it is a well-known fact that a large per cent. of firemen are not so constituted, and will not make the necessary effort unless convinced that excuse or evasion will be of no avail. Needless to add, it would be the prompt relaxation of these men to which could be traced the origin of a disgraceful failure sheet, and which would promptly follow should the suggestion which forms the basis of this mention be carried out.

Instead of so putting a premium on indifference and incompetency, it is far better to buy the best coal procurable and set a tangible monetary premium on economy of fuel for both the engineer and fireman. This is the plan largely followed in other countries than our own, and it is equally applicable here as there. The immediate gratifying result will be large decrease in fuel consumption, increased efficiency, and last but not least, a spirit of hearty cooperation, which is now, unfortunately, too often lacking.

THE IMPROVED BAKER-PILLIOD VALVE GEAR

One of the most important problems which the rapid locomotive development of the past few years has presented to motive power management in general is the consideration of the most efficient, practical and economical method for effecting steam distribution, and in this connection it is of much interest to note that at the present time certain types of radial valve gears are viewed with particular favor as embodying excellent features toward securing the ends desired.

A prominent example of this development is afforded in the improved Baker-Pilliod valve gear, manufactured by the Pilliod Company,* and which has been applied to many recently built locomotives. It is primarily designed to obviate the inherent defects which accompany the fixed or the shifting link, and to provide a simple manipulating and actuating device in combination with the standard slide or piston valves. The service returns from where applications have been made indicate that higher speed is possible with this gear; that a reduction in running repair costs has followed, and that more tonnage can be hauled with less fuel and water.



IMPROVED BAKER-PILLIOD DESIGN OF VALVE GEAR AS APPLIED TO A CONSOLIDATION LOCOMOTIVE

The old design of the Baker-Pilliod gear has been fully described and illustrated in this journal,† and its underlying principles, which of course, still apply, are no doubt fully understood, but before proceeding with a comparison between it and the present design it may be well to mention the subject of radial valve gears in general, in order to better make apparent how ordinarily existing defects have been overcome in this arrangement. The name radial valve gear has been applied to a number of reversing gears differing widely in general appearance and detail, but alike in basic principle, inasmuch that they all derive the mid-gear motion of the valve from some source that is equivalent to an eccentric with 90 deg. angular advance, and that they combine with this motion another equivalent to that of an eccentric with no angular advance.

Well-known examples of this design are the Walschaert, for which in this country the enormous increase in the size of locomotives was largely responsible; the Joy, which is extensively used in England and on the continent, and others not so generally known. Despite the popularity which these gears now enjoy, especially the former, it is nevertheless fully realized that there are certain errors in their design, the presence of which cannot be disputed. For instance, the slipping of the link block is a source of error in all motions, whether the radial link is fixed or shifting, but it is much more prominent in the latter case, arising from the much longer arc in which this form of link travels in comparison with the arc described where the link oscillates upon a fixed center.

This is the principal disadvantage of the Walschaert gear, and there is theoretically another in the fact of its constant lead, which may become apparent when the motion is applied to a locomotive intended to be operated at any considerable range of speed. In addition to the presence of the former defect in the Joy motion it has further disadvantages, arising from the number of its parts and joints liable to wear loose; more connecting, or main rod failures, and the interference which the vertical play of the main axle on a rough track exerts with the regular steam distribution.

It was to overcome these objectionable features that the Baker-Pilliod valve gear was originally designed. One of these intimately associated with the Walschaert is link block slip. It will be noted that the motion is pinned throughout; that the link is eliminated, and with it the error in the motion which is identified with link block slip. This is one of the most interesting features in this gear and particular stress is laid upon its unquestioned advantages. It might be added in this connection that all pins are in double shear. They are taper fitted, amply keyed, and equipped with castellated nuts, and every pin is so exposed that it is easily accessible for removal.

The improvements which have been made in the old design were by reverting to the original Baker patents, and by certain changes and valuable re-arrangement of details, which through comparison will become readily apparent. These have eliminated the original cumbersome character of the motion, and have established many features of advantage in construction which heretofore have been lacking.

The frame is now made in one piece instead of two, and the same casting serves for either side of the engine, replacing four castings which the former design necessitated. Another clever

* 80 Church Street, New York.
† See AMERICAN ENGINEER, January, 1909, page 32.

idea in connection with this part, and which has been well developed, was to provide the frame with an extension which will permit it to be used on a great variety of engines. It will no doubt be recalled that in the old design each locomotive class had to carry a special frame, therefore an important move has been made toward standardization.

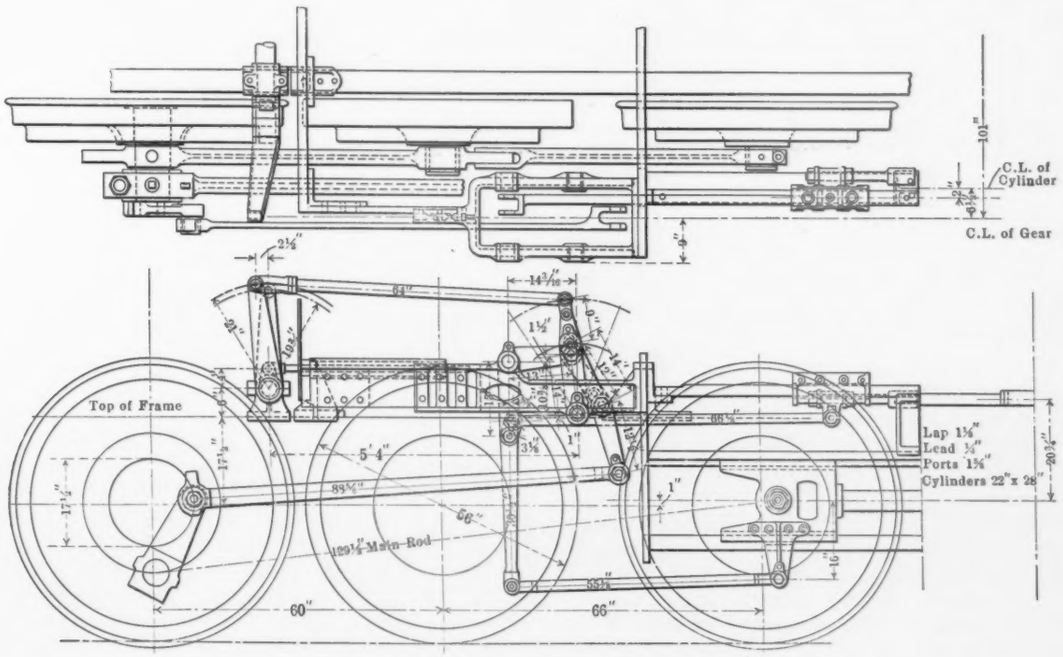
This is also noticeable in connection with other parts of the gear, particularly the bell crank, of which formerly a variety had to be used, on account of valve travel, while now it is possible to obtain sufficient travel and use the same bell crank for all classes. The new design of the latter, which is centrally hung from the frame, carries two vertical arms instead of one, and its position has been shifted forward so that the vertical arm connects to the gear connection rod, while the horizontal arm is on the center line of the gear.

A very important change has also been made in the combination lever which has been removed from the frame and hung between the two vertical arms of the bell crank. This arrangement greatly reduces the work formerly imposed upon the combination lever, as it no longer carries the weight of the back end of the eccentric arm and the front end of the eccentric rod, and it permits the use of a straight form lever similar to that employed in the Walschaert gear. Thus the new design materially improves this part, and dismisses the wear of the former bell crank pin, which in the old design of bell crank combination lever was an endless source of annoyance.

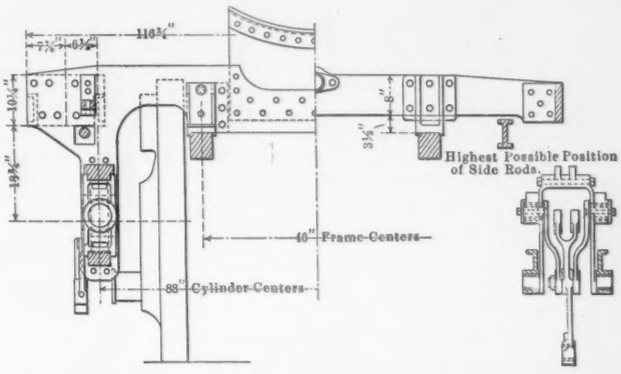
One of the most vexatious questions connected with the former gear was that of eccentric rod angularity, which, although not particularly prominent when a long rod could be used, was quite noticeable with the short rod which was often necessary. The bad effect of this feature has now been done away with by the use of the gear connection rod, formerly called the gear valve rod, through which it is possible to drop the front end of the eccentric rod to a point sufficient to minimize or eliminate all angularity. The gear connection rod also dispenses with the former eccentric arm, thus removing a part from the mechanism. It now connects the bell crank with the lower end of the radius bar, and continues on down to connect with the front end of the eccentric rod.

With the old gear the tumbling shaft was of the rocker arm design, as the direction of motion of the reverse lever had to be reversed. Now that this is no longer necessary the reach rod is straight from the yoke to the reverse lever, and furthermore the reach rod connects with the top of the yoke at the center, instead of on the inside, as was formerly the case. The yoke itself has not been neglected in the general betterments which have been accorded the motion, as it now lies forward in the go ahead position instead of backward, which was an unique and somewhat questionable characteristic of the former arrangement.

Special attention has been paid to the alignment of the gear in general. This is quite clear after a superficial study of the parts, which will plainly show that everything is centrally hung except the combination lever, and the reason advanced by the manufacturers for this exception is because this means is used to get from the center line of the eccentric rod to the center line of the valve. If there is to be any twisting motion at all in this gear as now improved it appears that the combination lever will be the only part to be effected, whereas in the original design undue stresses were imposed on many of the vital working parts.



GENERAL ELEVATION AND PLAN OF IMPROVED BAKER-PILLIOD VALVE GEAR

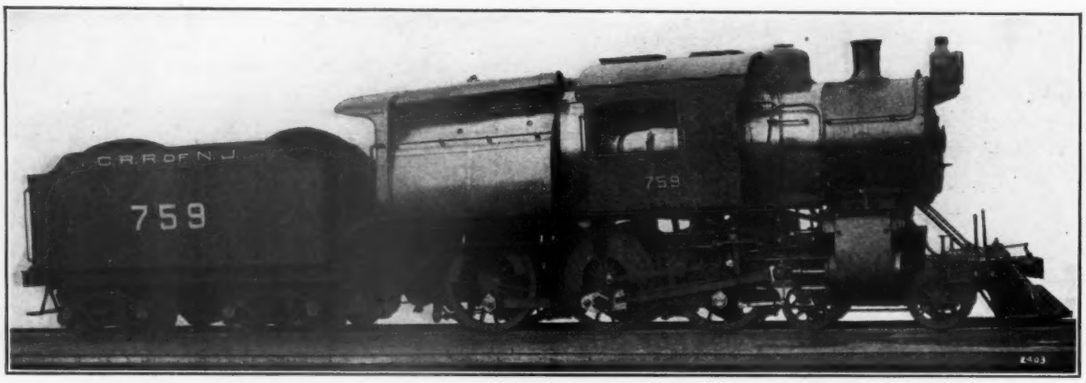


CROSS SECTIONS THROUGH VALVE GEAR

In their effort to thoroughly enhance the value of the new arrangement the Pilliod Company have not neglected the small details which so often become subjects of criticism. This is well exhibited in the care taken to provide an adequate oiling system, wherein every bearing, regardless of how much movement it may have, is equipped with an oil cavity which is integral with the part. On the larger bearings this cavity is very long, and there are two oil holes for proper distribution. This is a strikingly different arrangement from that of the old gear which was equipped entirely with loose oil cups, or mere oil holes.

It may be said also that the re-arrangement of parts embodied in the new design obviates the necessity of so many oil holes, and they are consequently greatly reduced.

As has been mentioned, the new design does away with the curved path of the front end of the eccentric rod, which in its original form was an irregular circle, transforming it into an arc, which permits the valve events to be more nearly square in all positions, back up as well as go ahead. It is also possible to equalize the port openings in full gear which could not be attained before these improvements were made. It can be readily seen that the Baker-Pilliod will produce a greater range of valve events by reason of permitting numerous modifications.



HIGH SPEED LOCOMOTIVE FITTED WITH THE IMPROVED BAKER-PILLIOD VALVE GEAR

In view of the fact that this device demonstrates satisfactorily that the motion of a slide valve can be perfectly controlled, and the length of stroke varied, without the intervention of a radial link, a real gain in the economical use of steam has been made. The ideal valve gearing for a locomotive must have the element of rigidity in a marked degree, and at the same time possess that flexibility of adaptation essential to the requirements of the service. These features appear to be happily realized in this construction, in the re-design of which the fact was borne prominently in mind that the best use of steam pressure is possible only when under perfect control.

NEW SHOPS AT EMPALME, MEX.

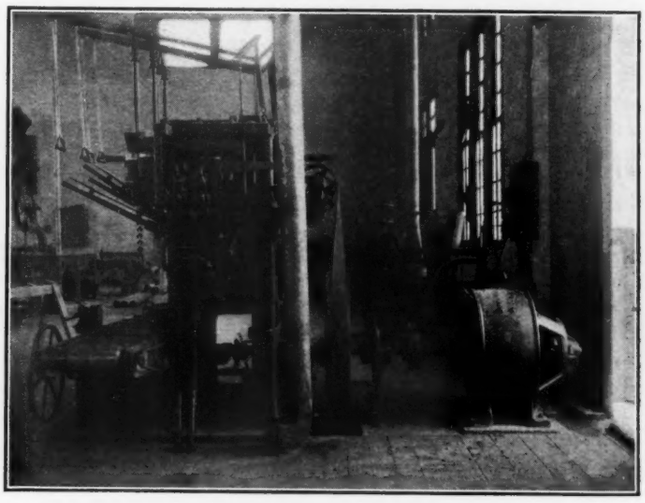
SOUTHERN PACIFIC R. R. OF MEXICO.

The general shops of the Sud-Pacifico de Mexico, herein illustrated, are located at Empalme, Sonora, the junction of this railroad and the Sonora Railway. About five years ago, when construction of the Cananea, Yaqui Railroad was started at a junction with the Sonora Railway, five miles east of Guaymas, the present site of Empalme was a waste covered with cactus, with not a single improvement except the bare lines of an old railroad. To-day it contains an up-to-date shop plant, equal to any west of the Rocky Mountains, and a modern American town site with first-class quarters for the company's employees. This rapid growth was due to the aggressiveness of Epes Randolph, who has been instrumental in the laying out and construction of the Southern Pacific road through Western Mexico, and who deserves practically all the credit for the road and the fine shops at Empalme. The selection of the location was not only because Empalme is central with reference to the lines north and south, but also on account of the climate, which, tempered by a continuous cool breeze from the Gulf of California, is said to be the most pleasant on the Mexican west coast.

Plans for the shop and construction were started about three years ago, and the first building completed was the twenty-eight-stall roundhouse. In this stone obtained from the company quarry 1½ miles from Empalme, was employed, but this construction proved that the rest of the buildings could be erected more economically from concrete, and plans were made accordingly. A test of the soil showed that it would either be necessary to put in large spread concrete footing under the piers carrying the large buildings with traveling crane loads, or to drive concrete piles, and it was eventually decided to adopt the latter plan.

Among the features of this complete plant are machine and erecting shops, boiler and blacksmith shop, material shed, bolt shop, flue shop, foundry, pattern shop, car and paint shops and mill. No detail was omitted to have the shops adequate to take care of locomotive, passenger and freight car repairing and rebuilding, and they are also equipped as a manufacturing plant, making them, to a large extent, self-supporting. Work is also to begin shortly on the erection of the dry lumber storage building and a dry kiln.

Particular attention has been given to labor and time saving devices. Cranes, push car tracks, turntables, floor air jacks, air hoists, etc., have been provided wherever considered practicable, and a telephone system connecting all shops, offices, stores, etc., is installed. A general fire alarm system, with fire alarm boxes located at suitable places about the shops and connecting with the power house, is provided for. An independent fire line with hydrants has been installed and is used only in case of fire or fire drill by the shop fire department, thus insuring piping in good condition that will stand high pressure in case of fire, and eliminating the dangerous practice of allowing general service and other taps to be connected to the fire line. All buildings are exceptionally well lighted, and, to eliminate the disagreeable feature of the strong sunlight, factory ribbed glass is used throughout. The coal storage has a capacity of ten thousand tons, the coal being dumped from an elevated trestle.

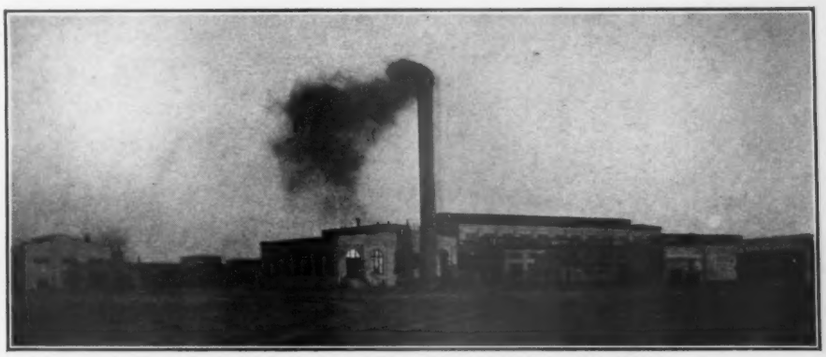


APPLICATION OF DIRECT MOTOR DRIVE TO MORTISING MACHINE

The shops are electrically driven throughout, power being fur-

nished from a central power station, which is a handsome reinforced concrete structure 88 feet wide and 106 feet long. This building is divided longitudinally by a wall extending its full length, separating the engine and the boiler rooms. The engine room floor is about five feet above the boiler room floor, which provides for a basement to accommodate condenser, air pumps, hot well, boiler washing, general service, hydraulic and fire pumps, steam and exhaust headers, and all piping. In the power house there are two Westinghouse 200 kw., three-wire, 250 volt D. C. engine type generators direct connected to reciprocating engines.

There are about 200 Westinghouse type "S" motors, from 1 to 50 h. p., operating the various wood and iron working machinery in the different departments. The machines are all direct driven and the necessity of overhead belts and line shafting is precluded. By means of the adjustable speed motors that are used, the speed control of the different machines is extremely flexible; and hence, a considerable gain in the productive capacity of the machines is made. The flexibility of control is especially advantageous in the machine shop.



GENERAL VIEW OF THE EMPALME SHOPS OF THE SOUTHERN PACIFIC R. R. OF MEXICO

SUCCESS OF THE ERIE'S APPRENTICE SYSTEM

The development of the Erie Railroad's system for the technical training of apprentices is proceeding rapidly, and before long will include practically all points on that system where a sufficient number of apprentices are employed to make the establishment of a school consistent. Those now in operation are at

HEAVY SLOTTER WITH DIRECT ELECTRIC MOTOR DRIVE IN THE EMPALME SHOPS

Meadville, Pa.; Susquehanna, Pa.; Dunmore, Pa.; Hornell, N. Y., and Port Jervis, N. Y., and 317 young men are receiving the benefit of a thorough practical course of education without cost to themselves.

This idea originated on the Erie in June, 1908, when it was decided to establish courses, not with the object in view to make mechanical engineers out of shop workmen, but to inaugurate an apprentice system to train its students to competency and skill in the mechanic arts, and also to interest in business, loyalty to the railroad, and familiarity with Erie standards and methods.

When the schools are open, between September 30 and June 1, the apprentices are required to attend the classes four hours per week; two hours on each of two different days during working hours, and for this time they are paid as though on the regular hourly shop rate. Instruction covers the fundamental rules of arithmetic, common and decimal fractions, proportion, simple problems in interest, tables and weights; the elementary principles of plain and solid geometry, mechanical drawing, practical and theoretical mechanics, and instructions in standard practices pertaining to the construction of cars and locomotives, as well as lessons in their successful and economical administration.

There is no doubt regarding the fact that the apprentices of the Erie fully appreciate their opportunity to receive a free technical education, one which supplemented as it is by daily practical experience in modern shops equipped with up-to-date tools, is really more valuable to them than a technical school or college could afford. Fifty-one young men have already completed the course and received certificates, and as an instance of loyalty to their alma mater it may be mentioned that all but three are now in the Erie employ as skilled mechanics.

FRENCH RAILWAY TO BE ELECTRIFIED.—The electrification of existing steam railways is being pursued with activity in France. One of the latest electrifications is that which the Midi Railway of France will make in connection with the Montrejeau-Pau portion of the Toulouse-Bayonne line. The portion to be electrified has a length of some 70 miles; the country is very hilly and the line has a number of steep gradients, one of 3½ per cent. being above seven miles in length. This is the largest scale upon which electrification of existing lines has been attempted in France, and the results will be watched throughout Europe with no little interest. Later the electrification is to be extended to the entire Toulouse-Bayonne line, a distance of 200 miles.

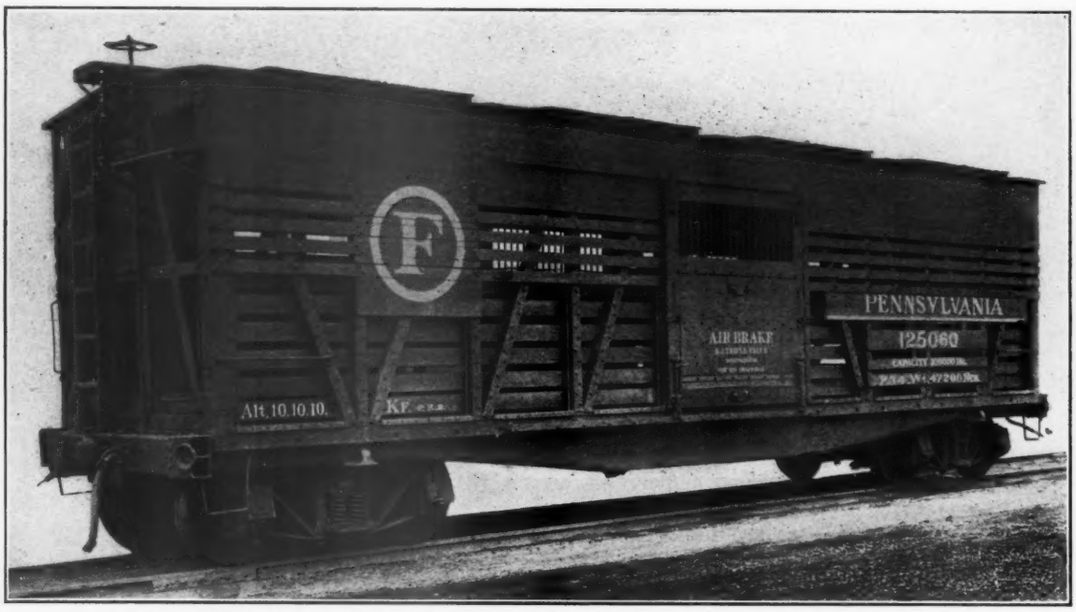
TELEPHONE TRAIN DISPATCHING.—G. K. Heyer, telephone engineer of the Western Electric Company, is authority for the statement that fifty-one railroads in the country, having a mileage of 35,000, are now using the telephone for train dispatching. The telephone is rapidly replacing the telegraph, and a number of the larger systems are making tests on their important divisions.

BRONZE FOR BEARINGS.—In a series of tests conducted by Italian engineers it was found that bronzes high in tin were too hard for use as bearings and that only those containing 10 per cent. or less were suitable.

NEW LIVE STOCK CAR

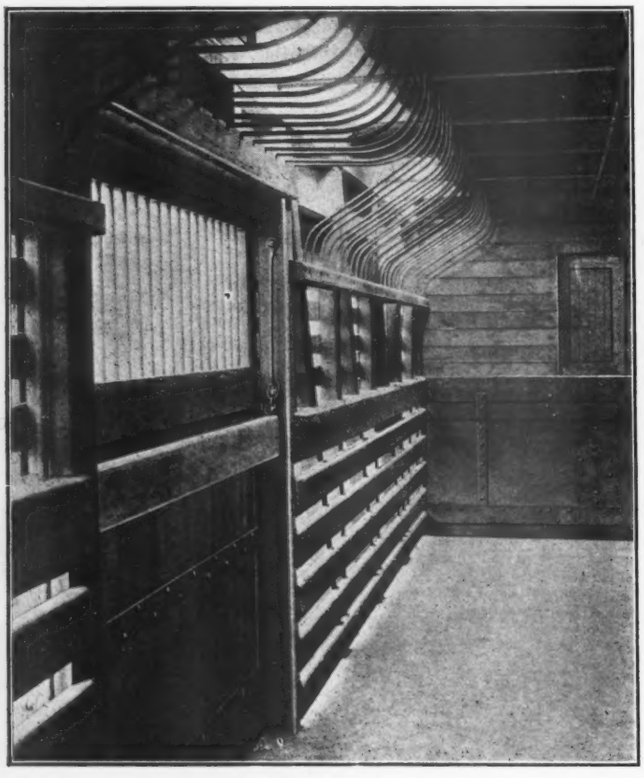
PENNSYLVANIA RAILROAD.

After devoting years to the development of the most suitable design for a standard stock car, the Pennsylvania railroad, in its class "KF," appears to have solved the problem with one which, while answering all service requirements, at the same time embodies many additional safeguards for the protection of the stock.



STANDARD STEEL UNDERFRAME STOCK CAR

This feature is particularly prominent in connection with the interior construction. All bolt heads and nuts on the inside have been rounded or countersunk, and all edges on side doors and interior walls with which the stock may come in contact have been rounded or chamfered. The floor is rough, in order to afford a firm foothold for animals, and being of oak on a steel underframe the possibility of sagging is eliminated, a feature when present which has resulted in many accidents to stock in transit though falling with the jerk of the train.



INTERIOR VIEW OF STANDARD STOCK CAR

Hay racks within the car extend from end to end, thus permitting feeding in transit, and the car has end sliding doors and handholds on bottom of carlins in order that attendants may enter. The roof of the standard stock car is of two ply thickness, and the upper portion of the hay racks and the ends of the car are boarded solidly to keep out all rain or snow. The trucks are fitted with graduated springs. The underframing, body, trucks and equipment follow the Pennsylvania railroad's specifications for 100,000 lbs. capacity cars with little variation. The general dimensions are as follows:

Length over end sills	38 ft. 6 in.
Length outside over body	36 ft. 11¾ in.
Length inside	35 ft. 11¼ in.
Width inside	8 ft. 5¼ in.
Width at eaves	9 ft. 10 in.
Height inside, floor to carlin, at side plate	8 ft. ¼ in.
Height from rail to floor	3 ft. 6¾ in.
Height from rail to running board	12 ft. 8⅝ in.
Height from rail to top of brake staff	13 ft. 2⅝ in.
Distance from center to center of trucks	28 ft. 6 in.
Wheel base of truck	5 ft. 6 in.
Centers of journals	6 ft. 5 in.
Size of journals	5½ in. x 10 in.

A model of this car was exhibited at Washington, D. C., October 10-15, on the occasion of the First International Humane Conference in America.

EFFICIENCY IN SHOP OPERATIONS.

It is generally conceded by managers of industrial as well as railroad shops and enterprises that high efficiency in equipment, in the methods employed, and also in the men, is one of the most desirable qualities to be attained. But the measure and development of efficiency and the remarkable results that must follow its cultivation have been clearly understood by but few. By those who are in a position to take a broad view of the situation it is clearly recognized that managements are generally realizing that the old methods are proving inadequate to present requirements, and that new ways are fast becoming a necessity.

This general subject was briefly discussed by H. F. Stimpson in a recent article in the *Iron Age*, and in commenting upon existing conditions he said:

"In the first place we must realize that the management of industrial enterprises is in a state of evolution. The tremendous growth of the past few years has caused certain previously satisfactory methods to become inadequate to present needs. Many details which in the days of smaller affairs could be absorbed by personal inspection and mentally stored for use when needed must now, because of their very volume, be made matters of record.

"The character of these records has much to do with their value. Because financial records are so ancient they have exerted an undue influence upon the character of all other records. While under our present civilization the ultimate object of industrial operations is to create financial profits, there are many highly important records which cannot be adequately expressed in terms of money. The business of manufacturing consists of a repetition of mechanical operations. Mechanical operations necessarily involve considerations of weight, distance, time and effort, but not of money.

"The reason for the failure of so many cost systems to serve the desired end is that they are based upon a wrong unit. These systems become useful only beyond a certain point. Other systems have been the result of a blind craving for aid, but being without broad underlying principles and not properly tied together and simply, in many cases, disjointed attempts to improve isolated details, they too have failed. The result is that attempts by specialists to improve industrial conditions have been often looked upon with suspicion and this is not altogether without reason. These very failures, however, have drawn the attention of men in certain lines of engineering to the rapidly developing needs of manufacturers. They have attempted to solve the problems by the use of engineering instead of by accounting methods, and the results which have been attained prove conclusively that a material advance has been made."

In view of this understanding of the present conditions and in discussing what efficiency really is, the old definition, "The ability to produce certain results," is employed, which at the very outset necessitates the existence or creation of a standard of measurement. And the author continues:

"This perception of efficiency, therefore, is correct only in proportion to the precision of the standard which must be accurately developed from data which are not only exact, but complete."

An example is given of a machinist, believed to be operating at very high efficiency, who was observed while turning a large shaft. His cut, feed and speed were beyond criticism, but when the shaft was finished he had to spend half as much time in hunting up a chain and pad to remove it from the lathe as he had taken for turning it. This reduced his actual efficiency from 100 per cent. down to 87 per cent., yet the man was not at fault, as his normal work was to operate a lathe and not to hunt for things which should have been provided for him. The points to be observed here are not only the importance of a standard of measurement, but that the efficiency of a mechanic depends largely upon his surrounding conditions over which he has no control, and which in turn depend mostly upon the efficiency of the management in securing the proper equipment. Finally this ability of the management in securing equipment depends to a great extent upon the efficiency of the records in showing clearly what increase in output and consequently in profits will result from improving the conditions, thus justifying the required expenditure. From this it is to be seen that the true standard consists of not the possibilities under existing conditions, but the possibilities under other and more desirable conditions.

The opposition offered to progress in this respect by managers in general, immediately controlling the records and conditions, but who should be the prime source of efforts towards increased efficiency, is exceedingly great, yet not altogether surprising, the author continues, for the following reasons:

"There is a widespread fallacy that so-called practical experience in the manual operations or technical processes of a business is the chief essential to success in its management. This is due to the fact that perfection of workmanship, of which he knows much, is more important in the eyes of the artisan than the actual cost of the operation, of which he knows little, or than the causes of this cost, of which he knows less."

The source of the highest degree of efficiency in a shop is unquestionably in the efficiency of its executive methods.

The necessity and value of a proper measurement of time, as a guide not only to the executive but to the workman as well, is most important, and the establishment of a correct standard, for this time measurement, although often very difficult, should be the first step in the attempt to increase the general efficiency. Every item of time can be divided into two parts: A standard or necessary time and a more or less preventable waste which later is the easier of the two to determine with a little careful study.

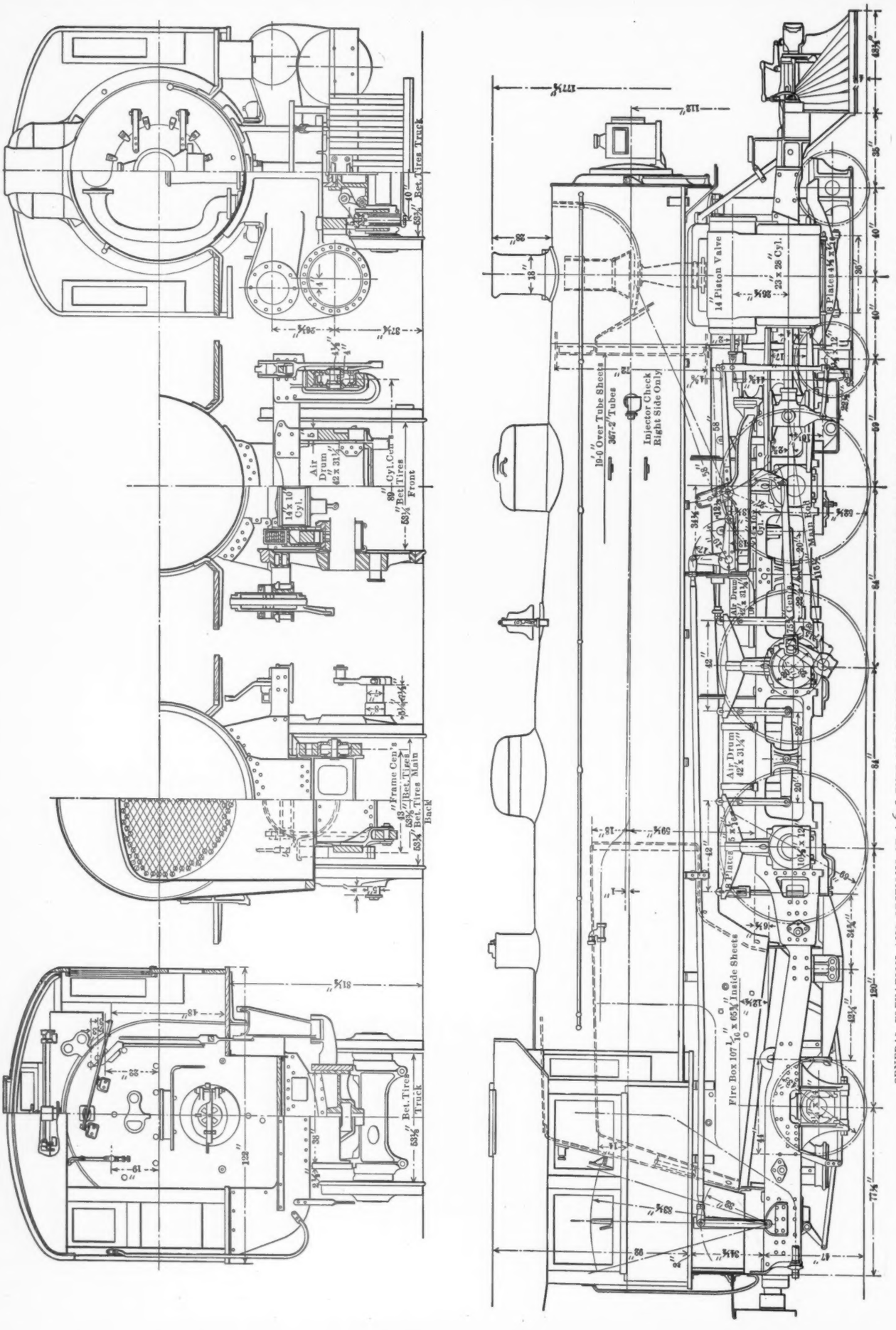
In regard to the bonus system as a means of increasing effiency Mr. Stimpson says:

"The principal merit of this motive lies in the fact that immediate personal gain is the strongest incentive to immediate personal effort. It operates just as strongly on the employee as on the employer. Hope of promotion is too vague and the actual chances too limited to exert much pressure, but an extra sum in the pay envelope—or better still, in a separate one—for the disposal of the "old man himself," will do wonders. To be most effectual a bonus must begin not at the point of standard efficiency, but at the point when average efficiency ceases and extra effort begins; and it should increase on a curve faster and faster as the point of standard efficiency is neared, because the accompanying effort will be correspondingly greater."

The same efficiency methods can and should be applied from foreman up to and including the highest official. Under ordinary circumstances, the workman in need of material, tools, or instruction, is content to depend largely upon the foreman, because he reasons this is his duty, as he himself is not paid for these things, but with the proper bonus system and on standard time he makes vigorous demands to the foreman when anything is wanting to enable him to do his best work. The foreman does not resent this—as would ordinarily be the case—for his efficiency is determined by the combined efficiency of his men upon which also his own bonus depends. In this way all defects which were previously hidden from the superintendent are now brought to his attention and he welcomes them for the same reasons that actuated the foreman, all this resulting in hearty co-operation of foremen and workmen and a high general efficiency.

The value of fully planning the apportionment of productive time by a special department before incurring any operating expenses cannot be too strongly emphasized, because in apportioning the different parts of the product, this value has long been well understood by engineers and designers. It is possible, but only to one trained in the particular art, to schedule the different operations on all the parts of the product, and to combine these time studies on a chart which will show the disposition to be made of all men and machinery, thus giving the superintendent and foremen the advantage of the same predisposition of time that they now have of material. In this way the foremen are enabled to order material in time and intelligently, thus not only simplifying the work of the shop transportation department, but also aiding the purchasing department, and finally enabling the sales department to make delivery promises which mean something.

As a result of a number of close investigations, the facts show that the inefficiency in manufacturing which exists more or less generally, in spite of the prevailing impression to the contrary, is only about one-fourth due to the things over which the employees have control and three-fourths to conditions imposed upon them by the management. So-called welfare work is a highly creditable and necessary line of effort in removing obstacles and producing cheerful conditions for the workman, but some incentive is necessary in addition to induce him to make the best possible use of the facilities when they are provided. Successful efficiency methods to provide this incentive, however, can be developed and installed only by one trained in this direction who has previously made a careful study of existing conditions. But after being actually put in operation, they may gradually be relinquished into the control of those who have been educated in the process of installation with some hope of success for their future operation and for the maintenance of the resulting increased efficiency.



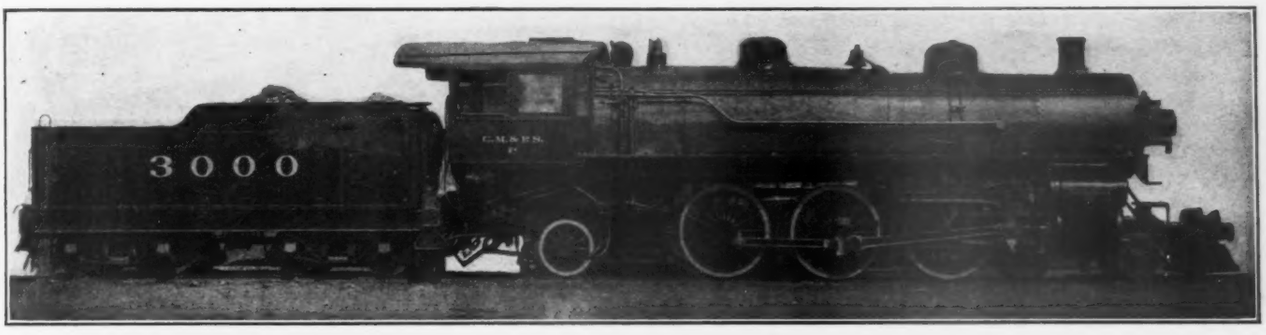
GENERAL ELEVATION AND SECTIONS OF 4-6-2 TYPE LOCOMOTIVE, BUILT AT THE WEST MILWAUKEE SHOPS OF THE C. M. & ST. P. RY.

Pacific and Consolidation Type Locomotives

SOME VERY POWERFUL FREIGHT AND PASSENGER LOCOMOTIVES DESIGNED IN THE OFFICE OF THE MECHANICAL ENGINEER OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY AND BUILT IN THE WEST MILWAUKEE SHOPS OF THE COMPANY

It has long been the custom of the motive power department of the Chicago, Milwaukee & St. Paul Railway to design many of its own locomotives. The latest examples of this practice, consisting of a new Pacific type and a consolidation type, are being built in the West Milwaukee shops of the company and are, therefore, throughout, a home production. To J. F. DeVoy, former mechanical engineer, now assistant superintendent of motive power, is due the principal credit for the work of designing. An inspection of the photographs and drawings given herewith show the particularly attractive appearance of both types and also indicate the remarkable simplicity and ruggedness that characterizes the arrangement throughout.

A careful study of the dimensions will show that while it has been clearly recognized that boiler capacity is the governing feature in any locomotive, particularly those in passenger service, these engines are well balanced between the boiler and cylinder capacity. The total number of square feet of heating surface divided by the volume of cylinders is in the case of the 4-6-2 type, 290.49 somewhat below other designs on our records, carrying the same steam pressure, but still not unusually low. It is also to be remembered that this balance has been decided upon in view of the experience gained by designing several other examples of this same type, which have been in service for some time. It should also be noted in this connection that the passenger boiler includes a combustion chamber 3 ft. long, having 53 sq. ft. of heating surface, which, while it largely reduces the total heating surface that would be given if the same space was filled with tubes, is probably equally valuable for evaporation.



POWERFUL PASSENGER LOCOMOTIVE DESIGNED AND BUILT BY THE CHICAGO, MILWAUKEE AND ST. PAUL RAILWAY

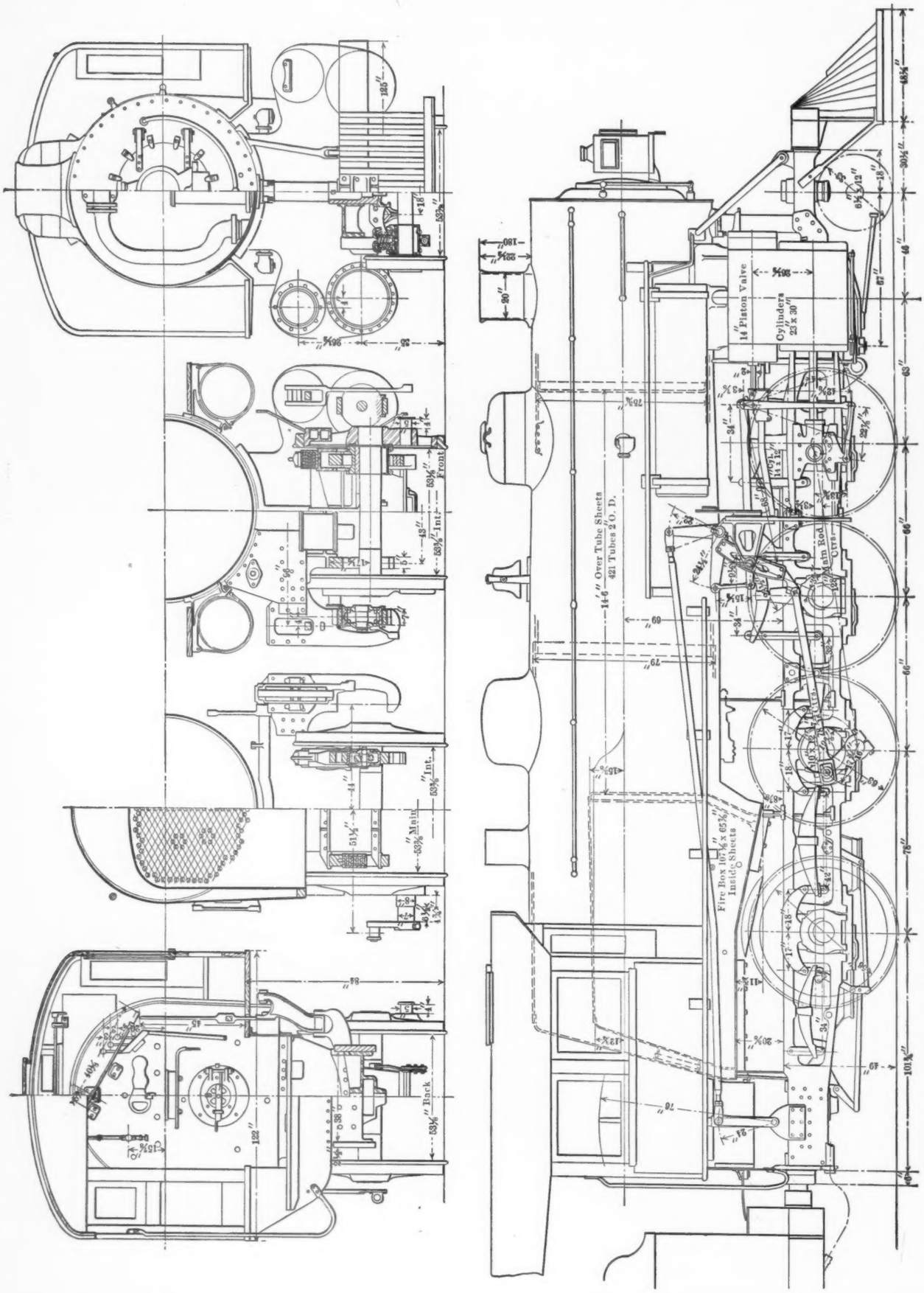
In the freight locomotive the heating surface to volume of cylinders is about 234, being in about the same relation to customary ratio as is the one on the passenger design. This boiler, however, does not have a combustion chamber, and its comparative small heating surface is due to the short length of tubes, these being but 14 ft. 6 in. over tube sheets.

Considering first the passenger locomotives. While these are designed for service at various points throughout the whole system, including the coast lines, probably their heaviest duty is represented by the service between Chicago and Milwaukee, a distance of 85 miles, in which the maximum grade is .6 of one per cent. The time in this service is two hours and ten minutes, including a number of stops and slow speeds. Trains on this division sometimes run as high as 18 parlor and chair cars.

In view of this service, it is interesting to investigate the design for capacity. Assuming an evaporation of 12 lbs. of water per square foot of heating surface per hour, the boilers will furnish 46,920 lbs. of steam per hour. If the steam consumption per indicated horse power is 25 lbs. the locomotive will deliver 1877 horse power. At 50 miles per hour on a straight, level track the horse power required per ton is 1.79, which gives a total tonnage that the locomotive can handle under these conditions at this speed, of 1042, including the weight of the locomotive itself. It can therefore handle about 900 tons behind the tender. This would be about 18 cars of the average weight of chair and parlor cars, showing that it will be able to maintain this speed with the train required on a level track. Since the average speed for the total distance is less than 40 miles per hour, it apparently is well suited for this particular service.

In connection with the boiler of this locomotive it is interesting to note that the experimental locomotive of the same type,* put into service by this company about five years ago, and equipped with a long, narrow firebox which attracted considerable attention at that time, has apparently not proved to be the success anticipated. That locomotive had 23 by 26 in. cylinders and carried 200 lbs. steam pressure, the wheels being 72 in. in diameter. The ratio between the grate area and total heating surface was 94.5. In the present design with the same diameter of cylinders and 2 in. greater stroke, same steam pressure, and wheels 3 in. less in diameter, the total heating surface has been increased over 15½ per cent., and the grate area 36½ per cent., the ratio of the two now standing at 80.12, which is well above the average for this type of locomotive. In considering this feature, however, it should be remembered that the grate area and all ratios concerned with it are dependent upon the quality of fuel that is being burned, and while the narrow firebox locomotive was designed for a particular service in a particular section and was reported to satisfactorily fill the requirements, the present locomotives are intended to be widely distributed, a number of them running in a district where semi-bituminous coal will have to be used. Investigating this feature on the basis of the B. D. factor (tractive effort multiplied by diameter of drivers divided by total heating surface) and comparing it with locomotives designed for use on roads in the same vicinity, and of about the same size, it will be found that when allowance is made for the effect of the size of drivers on the tractive effort it represents about the average of what is considered good practice for that region. The 22 by 28 in. Pacific type on the Burlington with 74 in. drivers has a B. D. factor of 605. A 23 by 28 in. on the Alton, with 80 in. drivers, gives 618. A 23 by 28 in. with 75 inch wheels on the Northwestern has a factor of 548. A balanced compound on the Northern Pacific with 220 lbs. pressure, 69 in. wheels, gives a factor of 720, and the same ratio for the locomotive built about five years ago, mentioned above, is about 690.

* See AMERICAN ENGINEER, March 19, 1905, page 74.



GENERAL ELEVATION AND SECTIONS OF 2-8-0 TYPE LOCOMOTIVE. A LARGE NUMBER OF THIS DESIGN ARE BEING BUILT AT THE WEST MILWAUKEE SHOPS OF THE C. M. & ST. P. RY.

A radial stayed conical type boiler is employed very similar to the design used on the same type locomotive in use on the Northern Pacific Railway.* The principal difference is in the length of the flues, which in this case are 19 ft. in place of 16 ft. 9 in. A liberal depth of throat is provided, the bottom of the mud ring being 25½ in. below the barrel. The side water legs are 4 in. in width and the inside firebox sheet is vertical, while the outside sheet has a decided inclination outward, the width of the water leg at the turn of the crown being 6¾ in. The combustion chamber is stayed by staybolts instead of plates and the firebox has four 3 in. arch tubes.

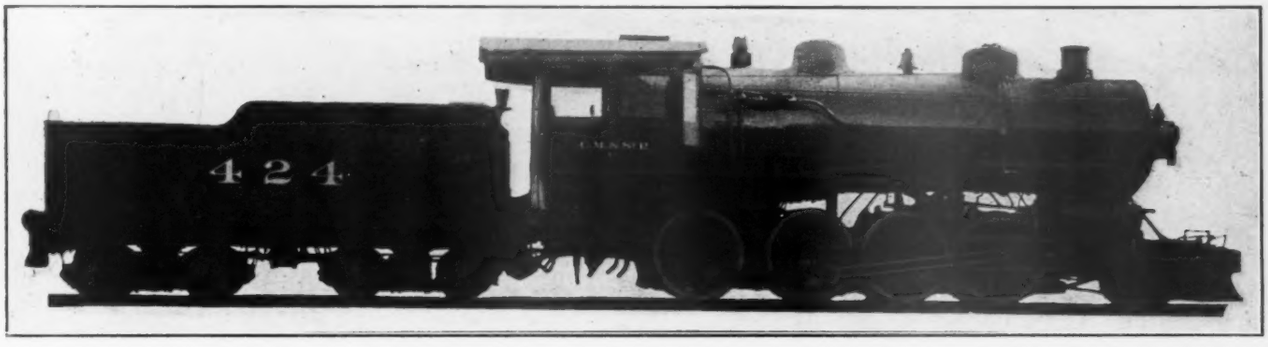
Reference to the illustration showing the general elevation and cross section will make clear all other features of the design and the general dimensions are given in the table at the end of the article.

Investigating the design of the freight locomotives on the same basis as used above in the passenger engines, and assuming an evaporation of 12 lbs. of water per square foot of heating surface per hour and a steam consumption of 30 lbs. of steam per h. p., at 10 miles per hour, it is indicated that this locomotive will be able to handle about 3,000 tons behind the tender up a .6 per cent. grade at a speed of 10 miles an hour. Since the tonnage trains between Chicago and Milwaukee are rated at about 2,600 tons and the average speed to be maintained is little more than 10 miles per hour, it is evident that this engine in that service will have a reserved capacity. An inspection of the various ratios indicate that it is well within the point of what is generally considered good practice for locomotives in this service.

There is nothing particularly unusual or novel in the general design, the features of which are clearly shown in the illustration.

It is planned to build 70 of the passenger locomotives, which are known as class F-3 and 75 of the consolidation engines, class C-2, at the Milwaukee shops. A number of these have already been turned out and are in service. The indications are that both classes are more than capable of filling the specifications. The general dimensions and other information are given in the following table:

VALVES.		
Kind	Piston	Piston
Diameter	14 in.	14 in.
Greatest travel	6 in.	6¼ in.
Outside lap	1 in.	1 in.
Inside clearance	⅛ in.	0 in.
Lead	¼ in.	¼ in.
WHEELS.		
Driving, diameter over tires	69 in.	63 in.
Driving journals, main, diam. and length	10½ x 12 in.	10 x 12 in.
Driving journals, others, diam. and length	10½ x 12 in.	9½ x 12 in.
Engine truck wheels, diameter	36 in.	33 in.
Engine truck, journals	6½ x 12 in.	6½ x 12 in.
Trailing truck wheels, diameter	43 in.	
Trailing truck, journals	8½ x 14 in.	
BOILER.		
Style	Straight	Straight
Working pressure	200 lbs.	200 lbs.
Outside diameter of first ring	72 in.	75¾ in.
Firebox, length and width	107 1/16 x 65½ in.	107⅛ x 65⅞ in.
Firebox plates, thickness	⅜ in.	⅜ & 5/16 in.
Firebox, water space	F. 4½, S. & B. 4 in.	F. 4½ in. S. & B. 4 in.
Tubes, number and outside diameter	369—2 in.	421—2 in.
Tubes, length	19 ft.	14 ft. 6 in.



HEAVY CONSOLIDATION TYPE LOCOMOTIVE DESIGNED AND BUILT BY THE C. M. & ST. P. RY.

Heating surface, tubes	3,651 sq. ft.	3,178.5 sq. ft.
Heating surface, firebox	206 sq. ft.	195.7 sq. ft.
Heating surface, comb. cham.	53 sq. ft.	
Heating surface, total	3,910 sq. ft.	3,369.2 sq. ft.
Grate area	48.8 sq. ft.	48.8 sq. ft.
Smokestack, height above rail	14 ft. 9½ in.	15 ft.
Center of boiler above rail	9 ft. 4 in.	9 ft. 10 in.
TENDER.		
Tank	Waterbottom	Waterbottom
Weight	134,550 lbs.	134,550 lbs.
Wheels, diameter	38 in.	33 in.
Journals, diameter and length	5½ x 10 in.	5½ x 10 in.
Water capacity	7,000 gals.	7,000 gals.
Coal capacity	10 tons	10 tons

GENERAL DATA.		
Gauge	4 ft. 8½ in.	4 ft. 8½ in.
Service	Passenger	Freight
Fuel	Bit. Coal	Bit. Coal
Tractive effort	36,500 lbs.	42,800 lbs.
Weight in working order	248,800 lbs.	215,700 lbs.
Weight on drivers	160,100 lbs.	189,200 lbs.
Weight on leading truck	46,000 lbs.	26,500 lbs.
Weight on trailing truck	42,700 lbs.	
Weight of engine and tender in working order	383,350 lbs.	350,250 lbs.
Wheel base, driving	14 ft.	17 ft. 6 in.
Wheel base, total	35 ft. 7 in	26 ft. 7 in.
Wheel base, engine and tender	67 ft. 1¼ in.	60 ft. 2 in.
RATIOS.		
Weight on drivers ÷ tractive effort	4.39	4.42
Total weight ÷ tractive effort	6.82	5.04
Tractive effort × diam. drivers ÷ heating surface	641.56	800.30
Total heating surface ÷ grate area	80.12	69.04
Firebox heating surface ÷ total heating surface, %	4.58	6.37
Weight on drivers ÷ total heating surface	40,95	56.16
Total weight ÷ total heating surface	40.95	64.02
Volume both cylinders, cu. ft.	13.46	14.40
Total heating surface ÷ vol. cylinders	290.49	233.97
Grate area ÷ vol. cylinders	3.62	3.38
CYLINDERS.		
Kind	Simple	Simple
Diameter and stroke	23 x 28	23 x 30

* See AMERICAN ENGINEER, October, 1906, page 394.

WESTINGHOUSE EXHIBIT AT THE ELECTRIC RAILWAY CONVENTIONS

The exhibit of the Westinghouse Companies in connection with the Convention of the American Street and Interurban Railway Associations, at Atlantic City, was in their usual location in the main building, and was particularly conspicuous on account of the complete and varied nature of the operating machinery displayed.

A feature of great interest to those in attendance, and which attracted much attention, was the principal exhibit by the Westinghouse Traction Brake Company of a rack representing the complete equipment of a 10-car subway or elevated train of motor and trailer cars, which was most effectively arranged to clearly portray the operation of the latest electro-pneumatic brake system. Another demonstration equipment represented the complete arrangement of brake details on a five car train fitted with the company's type "A M M" automatic equipment for interurban service.

The Westinghouse Electric and Manufacturing Company had on exhibition a complete working outfit of its new type "H L" multiple unit control for street and interurban lines. The exhibit also included the standard railway motors manufactured by the company, motors for shop machinery, transformers and incandescent lamps. The Westinghouse Machine Company and the Westinghouse Lamp Company displayed their products with equal attractiveness.

HOT WATER BOILER WASHING AND FILLING SYSTEM

The use of hot water for washing and filling locomotive boilers meets with general approval in this country, and to perform this operation with economy and dispatch has resulted in the production of various boiler washing systems, both by the manufacturing firms and the railroads themselves. While these differ considerably in their individual development, the basic principle remains practically the same, and all designs exhibit a praiseworthy effort to avoid complexity and the multiplicity of parts.

One of the most recent of these systems is that of the Cowles-MacDowell Engineering Company. It is a plant practically automatic in operation, and constitutes a continuous feed water heating system, one whose efficiency can be greatly increased through arrangements in the roundhouse which will permit the operations to be practically continuous, and with as few intervals of rest as possible. The accompanying diagram clearly illustrates the working of the system and its usual application to roundhouses.

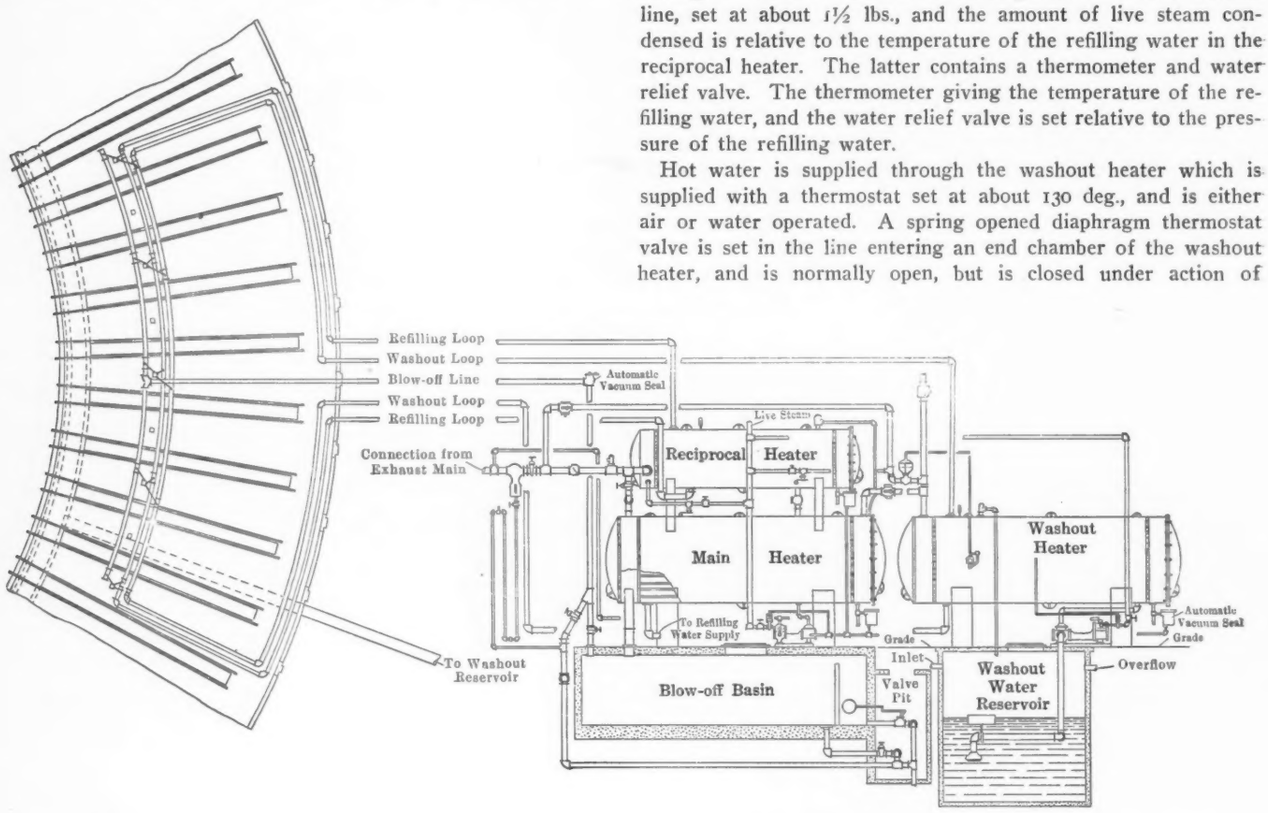


DIAGRAM SHOWING PARTS AND CONNECTIONS OF THE COWLES-MACDOWELL SYSTEM OF HOT WATER BOILER WASHING AND FILLING

Blow-off water and steam is delivered first into the concrete blow-off basin, which with all the heaters is under 9 in. vacuum, except when engines are blowing off. The hot vapor only of the blow-off water and steam is passed through the tubes into the main refilling and washout heaters. The heat is practically all extracted from the blow-off water, and the dirty water and sludge are left in the blow-off basin to be passed to the sewer. Such of the hot vapor as may condense in the tubes of the main heater passes through a vacuum trap to the suction of the vacuum pump, and is then discharged into the main heater through a receiver and automatic pump where it adds to the heat and quantity of the refilling supply. Surplus blow-off steam is passed to the washout heater as later described.

Water from the general water supply,—or treated water if such is used—is delivered into the bottom of the main heater between the tube sheets, under pressure from the general service pump, or from the city lines, or reservoir, as may be the case. In the first or main heater clean water is raised in temperature by its absorbing the heat from the blow-off, and it then passes into the reciprocal heater above the main heater where its temperature is raised to 180 deg. or higher, by its absorbing the heat from the exhaust or live steam, both of which circulate through the tubes in the heater. From this heater the refilling water passes to the roundhouse through a 3 in. or 4 in. main that returns full size to the reciprocal heater, the water entering again between the tube sheets and circulating around same as in the first instance. Efficient circulation is secured by the large pipe, constituting with the heater a circulating loop as shown on the drawing. Condensed steam in the reciprocal heater passes through a vacuum trap to the suction of the vacuum pump and then into the main heater, in the same manner as the condensation in the main heater.

Exhaust steam is first passed through an oil separator to an end chamber of the reciprocal heater, and then through the tubes of this heater. Live steam enters the same end of the reciprocal heater as does the exhaust steam, and circulates through the tubes. There is a reducing valve on the live steam line, set at about 1½ lbs., and the amount of live steam condensed is relative to the temperature of the refilling water in the reciprocal heater. The latter contains a thermometer and water relief valve. The thermometer giving the temperature of the refilling water, and the water relief valve is set relative to the pressure of the refilling water.

Hot water is supplied through the washout heater which is supplied with a thermostat set at about 130 deg., and is either air or water operated. A spring opened diaphragm thermostat valve is set in the line entering an end chamber of the washout heater, and is normally open, but is closed under action of the thermostat when the temperature of the washout water exceeds 130 deg. All waste water from the roundhouse, except that from toilet room, and including washout, waste spigot water, and down spout water, is drained to a large concrete reservoir near the heater house, where it is used for washout purposes only, thus conserving considerable water.

The washout pump takes its suction from this reservoir and passes it through the washout heater, where its temperature is raised as above described. The washout water then passes to the roundhouse through a 3 in. or 4 in. main that returns full size to the bottom of the washout heater between the tube sheets, permitting the water to again circulate around the tubes as in the first instance, thus ensuring efficient circulation. The condensed blow-off, exhaust, or live steam is passed through a vacuum trap to the suction of the vacuum pump, and then through the receiver and pump into the main heater, where it adds to the supply and temperature of the refilling water.

Exhaust steam from all pumps is discharged into the main exhaust steam line outside of the oil separator, and the pumps are controlled by governors in the usual way. A vent pipe with

a back pressure valve set at about 5 lbs. leads to the atmosphere from the end chambers of the washout heaters which constitute the main relief. Check and cut-out valves are set at the proper places and for the usual purposes. The heaters are built to pass Hartford Boiler Inspection. The washout and refilling lines are not cross connected in the roundhouse, consequently the washout gang cannot tamper with water, but must use same just as it is received from the heaters. Hot feed water can be supplied to stationary boilers from the refilling main and thus save the cost of feed water heaters; pumps, and installation of same, or giving the economy of hot feed water where cold water may now be used. The blast coils of a fan system, or the coils of any steamheating system, can be connected up with the vacuum pump of the washout plant, and thus insure efficiency and economy.

Where the saving of water is of importance all the waste or washout water can be used, heated to and delivered at the washing-out point at any desired temperature, and the blow-off and exhaust steam automatically diverted from the fresh water heaters to the washout heaters and vice versa for this purpose. Thus the steam is usel to heat the water first needed and then automatically diverted to the next to be used. Insuring water at the desired temperatures at all times for the different purposes, and these temperatures maintained at the delivery points, as in the washout water it is very essential that the first water entering the hot boiler being washed out should be at the desired temperature to prevent the rapid contraction of plates, staybolts, etc. Automatic diversion of heat is an important function and is found to be well provided for in this system.

HOLLOW CHISEL MORTISER FOR WIDE RANGE OF HEAVY WORK

This powerful machine has been especially designed by the Bentel-Margechant Co. for the heaviest line of mortising, taking chisels up 2½ in. square. It thus embodies an extremely wide range, being equally adapted for railroad and car shops, navy and ship yards, etc., and is built with a traveling carriage from 10 to 40 feet in length.

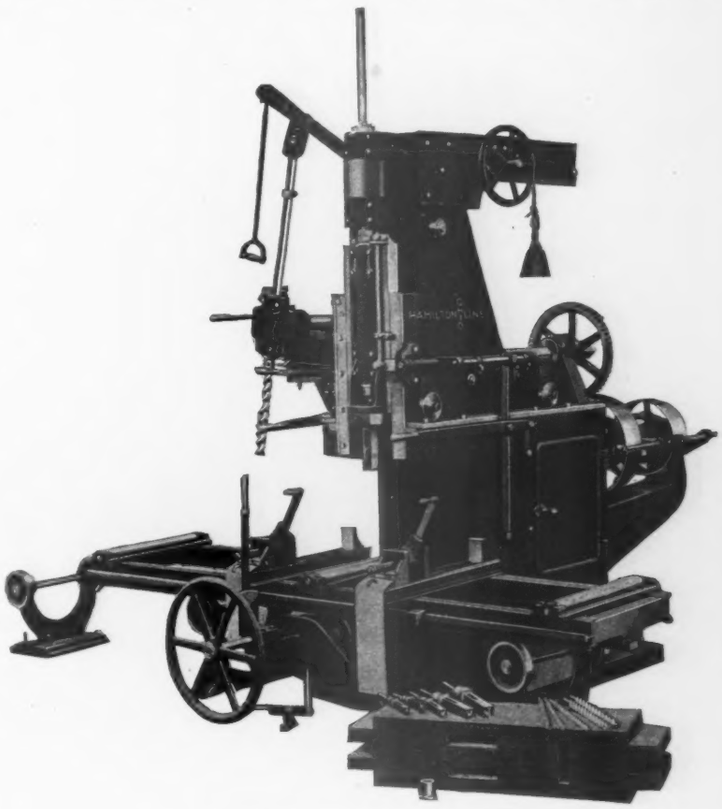
The illustration clearly indicates the unusual strength of the design as a whole. The frame is a single cored casting, with a wide base and solid support for the table. It carries the large housing on its top in square gibbed slides, supporting it by four rollers which run on the top surface of the gib. This movement is made with unusual ease through rack and pinion feed, controlled from the operator's position by a ratchet lever. The housing without counterbalance works in either direction.

It will be noted that the table is of very rigid steel beam construction to carry the heaviest timbers, and is mounted on large roller ways at even intervals. It has both power and hand feed; is provided with quick acting eccentric clamp, and will clamp material 20 in. wide by 16 in. The feature of adjustable stops along the front make provision to gauge accurately to length, and this is under full control of the operator through the power lever or hand wheels. The table can be stopped or started instantly.

Probably the greatest interest in the study of this machine centers in the actual mortising mechanism. The chisel ram, 29 in. long, mounted on the front of the housing in dovetail slides, is counterbalanced to take all weight from the working mechanism. The long, closed cap box holds the boring chisel rigid for running the latter at high speed without vibration, the driving pulley being carried between two boxes and sleeved in the same full length. The spindle sliding in sleeve prevents wear of boxes, and retains alignment against the heavy pull of the belt. The latter is controlled on the pulley by two idlers, one being automatically adjustable to take up variation in the belt length or position, owing to the belt being crossed as it comes from the countershaft above.

The chisel ram has 17 in. vertical movement and 16 in. transversely across the carriage, mortising 6 in. deep. The power is imparted by a train of gearing and reverse friction pulleys—all placed outside for ready inspection, adjustment, etc. The cutting speed of the chisel is 13 feet per minute, with return double this speed. The radial boring attachment can be used either on one side, as shown, on both sides, or may be omitted. It has 20 in. vertical adjustment, 16 in. transverse adjustment, and an angular adjustment of 30 degrees either way.

PRIZES FOR GOOD TRACK.—With a view to maintaining a healthy rivalry among its track Supervisors and Assistant Supervisors, the Pennsylvania Railroad offers annually the sum of $5,400 in premiums to those whose divisions have been kept in the most perfect condition during the year. The premiums for 1910, six in number, were distributed recently at Harrisburg on the close of the first day of the General Manager's Thirty-Eighth Annual Track Inspection.



HOLLOW CHISEL MORTISER FOR HEAVY WORK

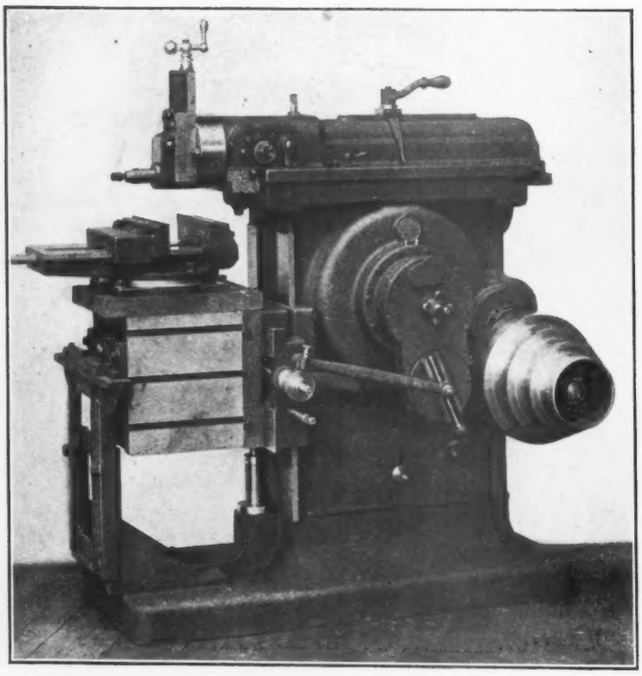
COAL LOST THROUGH THE STACK.—Prof. W. F. M. Goss, giving results of his test, estimates that of the 90,000,000 tons of coal consumed by the 51,000 locomotives in the United States in 1906, 720,000 tons were lost through incomplete combustion of the gases; 10,080,000 tons were lost through heat of gases discharged through the stack; 8,640,000 tons were lost through cinders and sparks, and 2,880,000 tons were lost through unconsumed fuel in the ashes. The figures indicate that there is considerable room for improvement in our present draft appliances.

ATLAS LEAD CEMENT.—A cement designed to take the place of lead for calking of pipe joints, etc., has recently been perfected. This cement is claimed to be twice as strong as lead and to cost about half as much. It sets without shrinkage and is remarkably simple to handle. Samples can be obtained from R. F. Lang, 31 Broadway, New York.

IMPROVED 16 INCH STOCKBRIDGE CRANK SHAPER

This 16 in. back geared shaper for toolroom work, or as a productive shop tool, has been designed with the idea of meeting all the requirements of up-to-date manufacturing, and to this end a heavy, rigid machine weighing 2,850 lbs., has been evolved. Besides the regular characteristics of Stockbridge Shapers, this machine embodies several new features designed to add materially to its productive capacity.

Among these is the column ways on which the cross rail slides. The method of attaching the cross rail to the column is new in shaper practice, though long employed in milling machine design. With this construction one gib is cast solid with the cross rail, which in addition to increased stiffness, prevents any possibility of the rail tipping away from the column when the adjusting gib, which is on the working side of shaper, is loosened. Through this construction no time is lost in going around machine to tighten and unloosen binder bolts every time the cross



AN INTERESTING 16-IN. CRANK SHAPER

rail is lowered or raised, which is necessary where two loose gibs are used. By simply tightening the gib binder screws on the working side of shaper the cross rail is locked to the column, a similar construction to that of a milling machine.

It will be noted that the rocker arm is of special design. The slide ribs are cored "U" shape, making an exceptionally strong construction, and the slot in the rocker arm is of unusual depth and width to provide ample surface for the crank block. The ram is carried around on a semi-circle on the top and the sides are built straight down. This construction, together with internal ribbing, gives an unusually strong and stiff ram. The head, which is accurately graduated, and can be adjusted to any angle, is locked in place by two bolts, one on either side. For taking up the wear in the ram ways, tapered packings are provided, which run the entire length of column and are adjusted from either end by means of screws. The automatic cross feed is so constructed that there is no necessity of changing the position of the cross feed rod, when it is desired to reverse the direction The reversing is done by moving the block in the slide to one side or the other of the center, the slide having a reciprocating motion. Bar screw is fitted with graduated collar reading to .001 of an inch, and down feed to head either hand, or automatic, can be provided. The head slide has a graduated collar reading to .001 of an inch, which can always be set from zero without regard to position of screw.

From the dimensions given below it will be noted that this machine is particularly heavy and of unusual capacity for a 16 in. machine:

Actual length of stroke	16¾ in.
Vertical travel of table	14¾ in.
Horizontal travel of table	23 in.
Minimum distance of ram to table	2½ in.
Maximum distance from ram to table	17 in.
Poppit takes tool	⅝ in. x 1¼ in.
Takes shaft for keyseating	2¼ in.
Vise opens	12 in.
Size of vise jaws	12 in. x 2½ in.
Tight and loose pulleys on countershaft	14 in. x 3½ in.
Speed of countershaft for cast iron	300 revolutions
Fin. Wt. of machine	2,850 lbs.

A NEW BASIS FOR PURCHASING BELTING.

Believing that the subject of belting is one that is not ordinarily given sufficient attention in railroad shops, this journal has during the past eighteen months devoted many columns of space to discussing belting manufacture, specifications and proper application. We feel sure that a systematic and intelligent following up of this subject will result in a decided saving, not only in the cost of belting itself, but also in relief from the interruptions and inefficient machine tool operation that unsuitable belting so often causes in the ordinary shop.

We are, therefore, pleased to announce that a new belting company has recently been organized and is preparing to distribute its product on a new basis. In the announcement of this company it is stated that it proposes to furnish belting which a careful study of all conditions shows to be suited to that particular work. The engineers of the company are to study the conditions and make the recommendations and then upon the basis of this report the company will guarantee that particular belt for that particular service for a specified length of time. Heretofore it has been the custom of manuafcturers to guarantee the fulfillment of certain specifications and qualities, which guarantee could only be checked by laboratory tests and there was no resource offered when the belt failed to perform its normal service if the tests showed it to fill the specifications. It is, of course, well known that a certain type of belt which is undoubtedly the best for one location or service is not by any means the best for others, and the engineering department of this new company proposes to study each individual application and to know which is the best belt for that purpose.

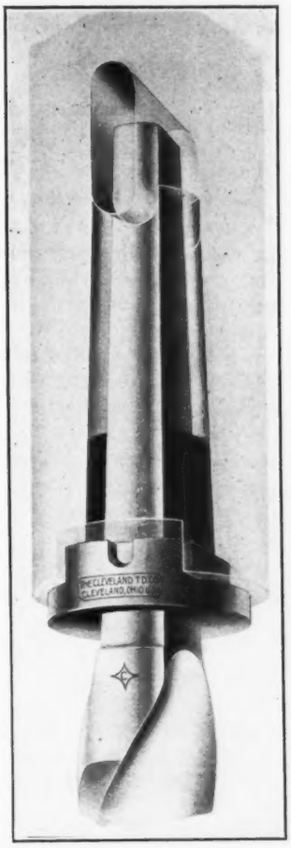
The firm issuing this announcement is the Olmstead-Flint Co., 136 Liberty St., New York.

STANDARD SOCKET DRIVE FOR FLAT TWIST DRILLS

The Cleveland Twist Drill Company, of Cleveland, O., has recently applied for patents on a device for driving flat taper shanks that are tapered both on the flat sides and round edges. Ordinarily these shanks, which are regularly furnished on this company's flat twist drills, are driven by sleeves or sockets internally equipped with flat taper holes coincident to that of the shanks, and externally tapered to fit standard taper sockets or spindles, but certain disadvantages are present in this arrangement, particularly in the case of large taper shanks, which cannot be adapted to the drill press spindles without the use of cumbersome reducing sockets. With the new device these latter are no longer necessary, and much additional driving strength is imparted.

To this end both the No. 5 and No. 6 "Paragon" shanks have been re-designed the same length as regular taper shanks, the taper on the round edges being regular Morse taper, as formerly. When this modified shank is inserted directly in the spindle the upper end of the shank is received and driven by the flat slot in the spindle just as is the tang of an ordinary taper shank drill. This alone would constitute a strong and practical drive, but for the lack of support the shank would have on its two flat sides at the lower end of the spindle. To provide against the

resultant possibilities of vibration and wear between the shank and spindle, and to furnish a powerful additional drive at the lower end of the shank where its cross sectional area is greatest,



COMBINATION OF NEW PARAGON COLLET WITH DRILL AND SPINDLE

a new and original type of socket, called the "Paragon" collet, has been evolved.

As herein illustrated, singly and in combination with the drill and spindle, the collet consists of two lugs projecting upward from a flattened disc through which is cut a rectangular hole to receive the shank. When the latter is applied it will be noted

THE NEW PARAGON COLLET

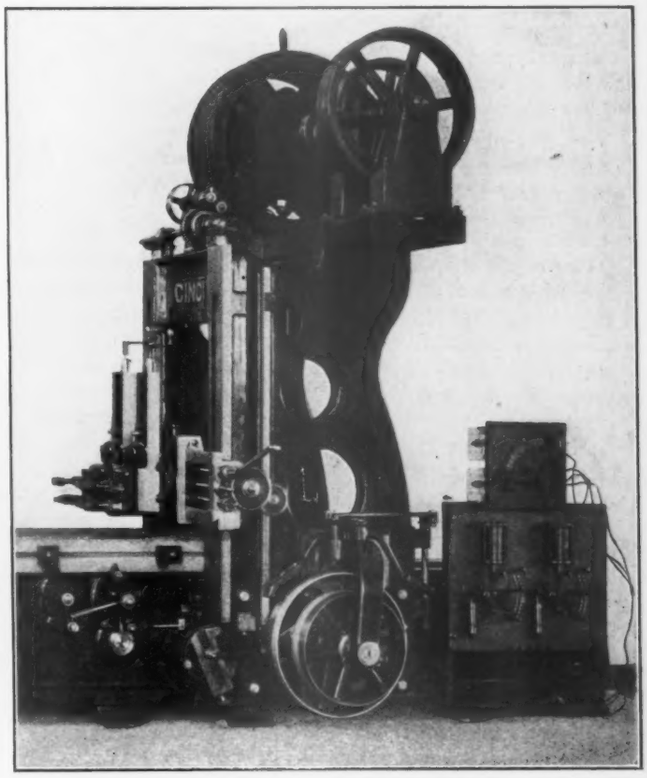
that the combination is practically an interchangeable taper shank with unusually long tang. The additional drive is protected by means of the extension, which is clearly shown projecting upward, in the case of vertical drilling, from the circular base of the collet. This projection mortises into a slot cut across the end of the spindle, conforming to the standard slots which several well-known manufacturers are now providing in the spindles of all heavy duty drill presses.

The collets are furnished without the extension, or mortise lugs, in instances where the spindles are not provided with slots, but it is of course understood that the additional driving strength will thereby be lost. That the tongue and groove drive at the large end of the shank is very much stronger than any drive on the tang could possibly be, is quite evident through a glance at the illustration, and it is also quite clear that a practically perfect drive is provided for in the instance of the larger sizes of flat twist drills.

A RECENT ELECTRIC VARIABLE SPEED DRIVE

A new electric speed controller, and its application to a 36 in. Cincinnati planer is clearly portrayed in the accompanying illustration. This consists of a motor drive arranged so that the operator can change the speed of the cut or return stroke to suit conditions. The motor is mounted on top of the planer, similar to a regular plain motor drive and is coupled direct to the countershaft, doing away with all gearing.

It is a two to one variable speed, controlled by the switch



APPLICATION OF ELECTRIC VARIABLE SPEED DRIVE TO 36 INCH PLANER

board located at the rear of the housings, on top of which is the usual starting box. On the large switch board are two controllers. One for the cutting stroke, by which any desirable speed can be obtained between 25 and 50 ft. without in any way altering the return, while the other controller is for the return speed, and this can be varied between 50 and 100 ft. without effecting the speed of the cut, so that it is possible to operate on a 40 ft. cut and a 60 ft. return, or a 20 ft. cut, with a 90 ft. return.

Immediately in front of the housing is a limit switch which operates these controlling levers, so that after they have been set for any particular speed, they will automatically return to that speed at each stroke. The wiring shown is only temporary, as this arrangement does not require any more than a regular drive, except that the wires must be run to the limit switch.

THE PENNSYLVANIA RAILROAD will shortly have available for use on its lines east and west of Pittsburg and Erie 1,988 solid steel passenger train cars. This includes some 600 Pullman parlor and sleeping cars, as well as a large number of suburban coaches such as the company's shops are just beginning to turn out.

The Railroad Clubs.

CLUB	NEXT MEETING	TITLE OF PAPER	AUTHOR	SECRETARY	ADDRESS
Canadian	Nov. 1	Recent Development in Signaling	A. H. Rudd	Jas. Powell	P. O. Box 7, St. Lamberts, Montreal, Que.
Central	Nov. 11			H. D. Vought	95 Liberty St, New York
New England	Nov. 8	Passenger Car Heating	Geo. E. Hulse	G. H. Frazier	10 Oliver St., Boston, Mass.
New York	Nov. 18	Railroad Relief Departments	J. N. Redfern	H. D. Vought	95 Liberty St., New York
Northern	Nov. 25			C. L. Kennedy	401 W. Superior St., Duluth, Minn.
Pittsburgh	Nov. 25			C. W. Alliman	P. & L. E. R. R., Gen. Office, Pittsburgh, Pa.
Richmond	Nov. 14	Election of Officers and Annual Reports		F. O. Robinson	C. & O Ry., Richmond, Va.
Southern	Nov. 17	Firing Locomotives		A. J. Merrill	218 Prudential Bldg., Atlanta, Ga.
St. Louis	Nov. 11			B. W. Frauenthal	Union Station, St. Louis, Mo.
Western	Nov. 21			J. W. Taylor	390 Old Colony Bldg., Chicago
Western Canada	Nov. 14	Electricity at Terminals	J. A. Douglass	W. H. Rosevear	199 Chestnut St., Winnipeg, Man.

THE TESTING DEPARTMENT

NEW YORK RAILROAD CLUB

At the September meeting the paper presented for discussion was entitled "The Testing Department of a Railroad Company," prepared by B. S. Hinckley, engineer of tests of the New York, New Haven & Hartford Railroad.

In the paper Mr. Hinckley draws attention to the practical value of a first-class testing department and points out the manner in which it saves a large railroad company considerable sums of money each year. He then takes up the matter of systematically handling and recording the work in the department and presents a number of blank forms used to cover the procedure of inspection and reporting most of the lines of work covered by the department.

One of the statements in the paper which aroused some objection from a few of the members was: "The testing department should be independent of all mechanical or engineering departments, for the chief economical results are secured only by giving freedom to the department of tests in its work of checking the quality, handling and use of the materials purchased."

P. H. Dudley, consulting engineer of the New York Central & Hudson River Railroad, confined his discussion quite largely to the subject of rails, pointing out improvements in manufacture which had gradually taken place; drawing attention to the value of the testing department in this work. He stated that the work of all testing departments will enlarge, and that besides making examinations of the ordinary purchases they should undertake a large amount of research work upon the results of service tests.

Among others who discussed this paper were H. J. Force, chemist of the D., L. & W. Railroad; Robert Job, who agreed with Mr. Hinckley that the head of the test department should report directly to the general or executive officer of the company; George A. Post; Eugene Chamberlain; F. P. Cheesman and H. H. Maxfield.

At the October meeting of the Club a paper on "Protection of Metal Equipment" was presented by William Marshall, president of the Anglo-American Varnish Co.

This paper was confined almost exclusively to the painting of steel passenger cars and was made up of the answers received to a series of questions sent out to the master painters of the various railroads.

ANALYSIS—CHEMICAL AND OTHERWISE

CENTRAL RAILROAD CLUB

At the September meeting E. M. Tewkesbury presented a paper in which he analyzed a number of features of railroad operation and pointed out the value of chemical analysis for a large number of materials used by railroads, particularly steel rails and other metals.

He spoke very strongly in favor of a careful chemical analysis of coal, and drew attention to the savings which have been claimed as a result of good firing, which can be far exceeded if coal of the proper quality, as shown by chemical analysis, was obtained all of the time. All coal should be purchased on the basis of specification.

Analysis of paint was also considered. The results of analysis of the membership of the Central Railroad Club was given, showing how many representatives there were of each different position. The locomotive engineers lead with sixty-five members, followed by thirty-one general foremen of the car department and twenty-four general foremen of the locomotive department. There are sixteen general inspectors; eight road foremen of engines; eight superintendents of motive power; seven superintendents; three mechanical engineers and one draftsman. The membership also includes seventeen chief clerks; one master plumber; one surgeon; four storekeepers; one freight solicitor, one arbitrator, etc., etc.

The paper was discussed by J. P. Kelly; D. L. Tuttle; John Talty, and others.

UTILIZATION AND CHEMICAL APPLICATION OF A BI-PRODUCT

RICHMOND RAILROAD CLUB

Dr. James M. Whitfield presented a paper on the above subject at the regular September meeting of this club. He confined his remarks entirely to coal tar, pointing out the great variety and enormous value. This included a discussion of the value of tar for roads and the method of applying it. He also considered tar roofing, flooring and other uses of tar. There was no discussion.

THE SECTION FORCE IN RAILROADING

NORTHERN RAILROAD CLUB

At the meeting of September 24, L. S. Morphy, designing engineer, Boston & Albany Railroad, presented a paper on the above subject. It considered briefly the work of the section gang in maintenance of the roadbed and track.

NEW COMMERCE COURT

WESTERN RAILROAD CLUB

At the October meeting Paul Synnestvedt presented a paper on the subject of "Special Courts," especially discussing the new Commerce Court soon to be organized. Mr. Synnestvedt is fully conversant with the situation and gave the members a very pleasant and profitable evening.

IRON CASTINGS

CANADIAN RAILWAY CLUB

Robert Job, vice-president Milton Hersey Co., Ltd., presented a paper before the September meeting of the Canadian Railway Club entitled "Iron Castings, Defects and Remedies," in which he discussed the effect of the various components of cast iron, pointing out the features of each that are an advantage and wherein they become a disadvantage. He also discussed foundry practice in its various features and presented a number of lantern slides, showing reproduction of etchings on iron.

The paper was discussed by Mr. Best, of Ward & King, Ltd., and Mr. Watson.

At the October meeting the paper was by P. McLaren, machinery expert, Grand Trunk Railway, entitled "Some Thoughts on the Training of Apprentices."

POSITIONS WANTED

CAR AND LOCOMOTIVE DRAFTSMAN.—Man with short experience on railroads and with car building companies wishes position as draftsman where opportunities for advancement are satisfactory. Address H. E. E.

SHOP FOREMAN.—A practical man whose experience includes drafting room, roundhouse, erecting shop and machine shop work, and who is now foreman of one of the best and most efficient shops in the country, desires a better position where ability will receive reward. Address F. G. Q.

MECHANICAL ENGINEER OR CHIEF DRAFTSMAN.—Long experience in the drafting room of railways; at present chief draftsman; wishes position on a southern railway. Address P. F. R.

CHIEF DRAFTSMAN OR SIMILAR POSITION.—Technical man, seven years' railroad experience now leading draftsman on locomotive and electrical work on one of the largest railway systems. Address E. J. W.

EXPERT ON MACHINE TOOL DESIGN.—Has had long experience with the design and building of machine tools and dealing with the problems of shop production. Well equipped for duties as director of a trade school or similar work. Address S. C. J.

DESIGNER OF RAILROAD SPECIALTIES.—Man thoroughly experienced in railroad design now chief draftsman of one of the largest systems wishes position with a supply company handling railway specialties that require a designer of exceptional ability. Address R. L. W.

SALES ENGINEER, INSPECTOR OR MECHANICAL ENGINEER.—Graduate in mechanical engineering, with nine years' practical experience in capacity of special apprentice, draftsman, chief draftsman, roundhouse foreman, mechanical inspector and chief estimator with railroads and steel car manufacturing concern. Thoroughly experienced in mechanical lines and exercising of executive ability. Address S. F. W.

BOOKS

Work, Wages and Profit. By H. L. Gantt. 5 x 7½. 199 pages. Published by the Engineering Magazine, 140 Nassau street New York City. Price, $2.00.

"The ratio of what can be done to what is done is even greater than three to one in work requiring skill and planning. Well thought out plans alone if accompanied by complete instructions for doing work often produce an increase of more than 100 per cent. over what is usually done." In these words Mr. Gantt accurately states a condition which exists in practically every line of work throughout the whole country. This condition is one which not only benefits no one but actually is a decided detriment in any way it may be looked upon. It is a condition which should be a source of national shame, but luckily it is also one that can be remedied. In this book, which is positively fascinating to anyone interested in the subject, the author points out very clearly that this frightful inefficient condition of labor is not by any means the fault of the workman, who throughout has taken the most logical and natural course under the conditions existing, but it is very decidedly the fault of the managers. Luckily a great majority of these are capable of being educated, and Mr. Gantt, together with others like him, may have an opportunity of seeing their efforts rewarded by general improvement in the efficiency of labor throughout the country.

There is nothing intricate or difficult in the schemes proposed as a remedy, and in this book, which is a collection of papers and articles written by the author at various times, the basic principles of the proper scheme of progress are briefly but very clearly brought forward. The whole problem is summed up by the author as consisting of but three parts; first, to find out the proper day's task for a man suited to the work; second, to find out the compensation needed to enthuse such men to do a full day's work; third, to plan so that the workman may work continuously and efficiently. It is also pointed out by the author that the proper method of payment is really one of the minor parts of the whole problem. In solving this problem Mr. Gantt has evolved what he calls the "task work with a bonus" and states that the elements on which this system is founded are as follows: 1. A scientific investigation in detail of each piece of work and a determination of the best methods and shortest time in which the work can be done. 2. A teacher capable of teaching the best method in the shortest time. 3. Reward for both teacher and pupil when the latter is successful. In explanation of the practical working of the system recommended a number of real examples are shown and discussed.

This is one of the most important books of its kind published in years. It deals with a subject which is of interest and importance to the whole country and should be read by every man who is in any way responsible for workmen.

Poor's Manual of Railroads for 1910. Forty-third annual edition, 2,685 pages. Published by Poor's Railroad Manual Co., 68 William street, New York. Price, $10.00.

This number is devoted exclusively to statements of the railroads and street railways, the statements of industrial corporations having been incorporated in a separate book mentioned in the Sept. issue of this journal. The present manual appears in a new and attractive type, larger and more legible than that used in former editions, with a new feature consisting of a number of analytical tables, so constructed as to offer a test of the financial strength and the operating efficiency of every important system. These tables, which have never been presented in a reference work, will be found very valuable.

The total mileage of steam railroads on December 31, 1909, is reported as 238,356 miles, against 232,046 miles on December 31, 1908, showing an increase of 6,310 miles. The gross earnings of these roads for 1909 was reported as $2,513,212,763, showing an increase of $106,192,953 or 4.41 per cent., and the net earnings for 1909 were $852,153,280, an increase of 18.72 per cent. The capital stock was $8,030,680,963 for 1909, an increase of about $389,000,000 or 5.09 per cent. over that of the previous year. The funded debt was $9,118,103,813, an increase of only 3.75 per cent. The revenue per ton mile was 0.757 cent, as against 0.767 cent in 1908, and per passenger mile was 1.934 cents, as against 1,964 cents in 1908.

Twentieth Century Sheet Metal Worker. By H. E. Osborne. 86 pages, 5 x 7½. Illustrated. Published by the American Artisan, 355 Dearborn street, Chicago, Ill. Price, cloth, $1.00; paper, 60c.

Mr. Osborne is a practical sheet metal worker of many years experience, and has recognized the need of a popular priced pocket reference book of short cuts and quick methods, combined with accurate information for the tinner or sheet metal worker. He therefore in writing this book has eliminated all long winded scientific rules and explanations, and has given plain, straightforward, clean cut information in simple language, which, while it is suitable for the youngest apprentice, is equally valuable for practical use of the journeyman. The illustrations are large and well arranged and with all the book seems to be particularly well suited for the use intended.

PERSONALS

C. M. STANSBURY has been appointed master mechanic of the Ocean Shore Ry., with office at San Francisco, Cal.

J. F. FARRELL has been appointed purchasing agent of the Detroit & Charlevoix R. R., with office at Detroit, Mich.

J. E. CAMERON has been appointed master mechanic of the Kentwood, Greensburg & Southwestern R. R. at Gulfport, Miss.

E. L. BURDICK has been appointed assistant engineer of tests of the Atchison, Topeka & Santa Fe Ry., with office at Topeka, Kan.

E. D. BRONNER has been appointed superintendent of motive power of the Detroit & Charlevoix R. R., with office at Detroit, Mich.

P. J. HANNIFAN has been appointed road foreman of engines of the Rochester division of the Erie Railroad, with office at Avon, N. Y.

S. A. ROGERS has been appointed road foreman of engines of the Baltimore & Ohio Southwestern R. R., with office at Seymour, Ind.

P. G. LEONARD has been appointed road foreman of engines on the Hocking Valley Ry. at Columbus, Ohio, succeeding L. C. Engler, deceased.

HENRY S. BRYAN, superintendent of motive power of the Duluth & Iron Range R. R., at Two Harbors, Minn., died October 2 at Rochester, Wis.

C. A. KOTHE, assistant general foreman in the Jersey City, south side, shops of the Erie Railroad, has been promoted to general foreman at Bergen, N. J.

A. M. GRACIE has been appointed foreman of the car department of the Northern Central Ry. at the Elmira, N. Y., shops, succeeding J. W. Hawthorne, deceased.

C. H. NORTON, general foreman at Bergen, N. J., on the Erie Railroad, has been transferred to Jersey City in a similar capacity, succeeding F. H. Murray, promoted.

W. A. YANDA has been appointed machine foreman on the Northern district of the Rock Island Lines, with office at Cedar Rapids, Iowa, succeeding P. F. Low, resigned.

H. F. WARDELL has been appointed superintendent of motive power and equipment of the Chicago & Western Indiana R. R., and of the Belt Railway Company of Chicago.

CHAS. DRURY, general foreman at Albuquerque, New Mexico, has been appointed division master mechanic at Arkansas City, on the Atchison, Topeka & Santa Fe Ry.

G. W. RUSSELL, master mechanic of the New York, Philadelphia & Norfolk R. R. at Cape Charles City, Va., has been appointed general equipment inspector of that road.

C. A. BRANDT has been appointed mechanical engineer of the Cleveland, Cincinnati, Chicago & St. Louis Ry., and the Peoria & Eastern Ry., with headquarters at Indianapolis, Ind.

C. JAMES, formerly master mechanic on the Erie Railroad at Port Jervis, N. Y., has been transferred in a similar capacity to Jersey City, N. J., succeeding John J. Dewey, resigned.

C. M STONE has been appointed machine foreman on the Terminal and Illinois divisions of the Rock Island Lines, with office at Chicago, succeeding W. Marks, assigned to other duties.

F. A. CHASE, formerly general mechanical inspector of the Chicago, Burlington & Quincy R. R., has retired from active service after almost 61 years of railway and mechanical work.

M. A. KINNEY, master mechanic of the Hocking Valley Ry. at Columbus, Ohio, has been appointed superintendent of motive power, with office at Columbus, succeeding G. J. De Vilbiss, deceased.

F. H. MURRAY has been promoted from general foreman of the Erie Railroad shop in Jersey City, N. J., to master mechanic of the Delaware division of that road, with office at Port Jervis, N. Y.

W. J. HILL, formerly division master mechanic of the Atchison, Topeka & Santa Fe Ry., at Arkansas City, Kan., has been appointed division master mechanic at Amarillo, Tex., vice J. R. Cook, resigned.

O. S. JACKSON, master mechanic of the Chicago, Indianapolis & Louisville Ry., at Lafayette, Ind., has been appointed superintendent of motive power, with office at Lafayette, succeeding John Gill, resigned.

GARRETT VLIET, assistant master mechanic of the Grand Trunk Ry., at Portland, Me., has been appointed master mechanic of the Western division, with office at Battle Creek, Mich., succeeding W. Hamilton, resigned.

PAUL L. GROVE, assistant master mechanic at the Altoona shops of the Pennsylvania Railroad, has been appointed assistant engineer of motive power of the Buffalo division of that road, with office at Buffalo, N. Y.

JAMES L. CUNNINGHAM has been promoted to master mechanic of the New York, Philadelphia & Norfolk R. R. at Cape Charles, Va. He was formerly assistant master mechanic on the Pennsylvania R. R. at Williamsport, Pa.

L. L. WOOD, formerly general foreman of shops of the Evansville & Terre Haute R. R., and since August acting superintendent of motive power, has been appointed superintendent of motive power, with office at Evansville, Ind., succeeding G. H. Bussing, resigned.

C. L. MCILVAINE, assistant engineer of motive power of the Buffalo division of the Pennsylvania Railroad, at Buffalo, N. Y., has been appointed assistant engineer of the Erie division of the Pennsylvania Railroad and the Northern Central Ry., with office at Williamsport, Pa., succeeding J. L. Cunningham, promoted.

P. H. COSGROVE has been appointed General Car Inspector, to look after all matters pertaining to Car Equipment, Repairs and Inspection, with jurisdiction over the Oregon Short Line R. R. and Southern Pacific Ry. lines east of Sparks. Previous to accepting this position Mr. Cosgrove was General Car Foreman of the Denver & Rio Grande R. R.

ARCHIBALD C. ROBSON, for many years stationed in Buffalo as master car builder of the Lake Shore & Michigan Southern Ry., died October 6, at his home in that city, aged 80 years. Since retirement from the railroad service he had been the founder, and for many years was president and vice-president, of the Erie Savings and Loan Association. He was also one of the founders of the Central Railway Club.

J. T. BRADY, superintendent of shops of the New York, New Haven and Hartford R. R., at New Haven, Conn., has been

transferred to the Readville shops, and Geo. Donahue, superintendent of shops at Readville, has been transferred to New Haven. Mr. Brady was for several years master mechanic at Norwood Central, Mass., in charge of the Midland division of the New Haven road, and he now returns to within a few miles of the scene of his earlier efforts.

FOR YOUR CARD INDEX

Some of the more important articles in this issue arranged for clipping and insertion in a card index. Extra copies of this page will be furnished to subscribers only for eight cents in stamps.

Acetylene Welding Torch AMER. ENG., 1910, p. 431 (November).

An article by J. F. Springer in which the mixing of the gases in the tip is considered, with a general discussion on the method of obtaining the high temperature, and how to use the torch in practical work.

Apprenticeship System—Erie Railroad
AMER. ENG., 1910, p. 445 (November).

Brief notice, showing the success that has accompanied the apprenticeship system on this road after its first year.

Boiler—Locomotives AMER. ENG., 1910, p. 421 (November).

A review of the reports presented at the recent session of the International Railway Congress. These reports indicate a sad lack of uniformity in practices in the various countries and offer little prospect of immediate improvement. This article is confined very largely to a discussion of foreign practices.

Car—Stock—P. R. R. AMER. ENG., 1910, p. 446 (November).

Illustrated description of some excellent stock cars recently put into service on the Pennsylvania R. R.

Locomotive, 2-8-8-2 Type AMER. ENG., 1910, p. 427 (November).

Total weight, 448,750 lbs.
Weight on drivers, 405,400 lbs.
Wheels, 56 in. diameter.
Cylinders, 20 and 40 x 32 in.
Tractive effort, 97,200 lbs.
Total heating surface, 5,203 sq. ft.
Feed water heating surface, 694 sq. ft.
Steam pressure, 210 lbs.

Built for the Virginian Ry. by the Baldwin Locomotive Works, for service on a 2 per cent. grade.

Locomtoive 2-8-0 Type AMER. ENG., 1910, p. 449 (November).

Total weight, 215,700 lbs.
Weight on drivers, 189,200 lbs.
Cylinders, 23 and 30 in.
Tractive effort, 42,800 lbs.
Wheels, 63 in.
Total heating surface, 3,369.2 sq. ft.
Steam pressure, 200 lbs.

Designed and built by the C. M. & St. P. Ry.

Locomotive, 4-6-2 Type AMER. ENG., 1910, p. 448 (November).

Total weight, 248,800 lbs.
Weight on drivers, 160,100 lbs.
Cylinders, 23 x 28 in.
Tractive effort, 26,500 lbs.
Wheels, 69 in.
Total heating surface, 3,910 sq. ft.
Steam pressure, 200 lbs.

Designed and built by the C. M. & St. P. Ry.

Locomotive—4-6-4 Type AMER. ENG., 1910, p. 435 (November).

Total weight, 236,000 lbs.
Weight on drivers, 135,000 lbs.
Cylinders, 20 and 26 in.
Superheating surface, 366 sq. ft.
Wheels, 63 in.
Total heating surface, 1,801 sq. ft.
Steam pressure, 200 lbs.
Tractive effort, 28,100 lbs.

A powerful suburban tank locomotive, designed and built by the Canadian Pacific Railway. The design includes a number of parts built up of steel plates and shapes. These are fully illustrated in this article.

Machine Tools—16-Inch Crank Shaper
AMER. ENG., 1910, p. 454 (November).

A new 16-inch shaper designed by the Stockbridge Machine Tool Co.

Machine Tools—Electric Drive for Planer
AMER. ENG., 1910, p. 455 (November).

A new electric speed controller applied to the Cincinnati planer. Permits a wide variation of the traverse and return of the table.

Machine Tools—Hollow Chisel Mortiser
AMER. ENG., 1910, p. 453 (November).

Powerful machine built by the Bentel and Margedant Co. Specially adapted for railroad car shops.

Piece Work—The Pioneer in Introducing
AMER. ENG., 1910, p. 428 (November).

A review of the Baltimore & Ohio experiment of 20 years ago in introducing piece work in the motive power department.

Shops—S. P. R. R. at Empalme, Mex.
AMER. ENG., 1910, p. 444 (November).

Brief, illustrated description, largely considering electric equipment.

Valve Gear AMER. ENG., 1910, p. 442 (November).

Fully illustrated description of the improved Baker-Pilliod valve gear.

Wheels—Test for Determining the Roundness of Chilled
AMER. ENG., 1910, p. 425 (November).

Report of some careful measurements made on newly cast wheels, with illustrations showing in an exaggerated form the shapes discovered; also suggestions for improving the practice to obtain better results.

CATALOGS

IN WRITING FOR THESE PLEASE MENTION THIS JOURNAL.

WATER SOFTENER.—The L. M. Booth Company, 136 Liberty St., New York, has issued a circular describing the type "G" Booth water softener, which appliance has met with hearty approval for its simplicity of construction.

LOCK NUTS.—The Columbia Nut and Bolt Co., Inc., Bridgeport, Conn., has issued two illustrated booklets describing the "Original" and the "Improved" lock nut, and pointing out its superiority over other forms of tight fastenings for bolts.

SINGLE PHASE INDUCTION MOTORS.—Bulletins 3139 and 3140, issued by the Emerson Electric Mfg. Co., St. Louis, Mo., describe respectively the back-geared types with countershaft, of ⅓ and ½ horse power, and the full load clutch types of 1/20 to ½ horsepower.

CAR VENTILATORS.—A circular issued by Burton W. Mudge and Company, 1023 People's Gas Building, Chicago, Ill., describes the Garland car ventilator for interurban, street, elevated, subway and tunnel cars, and thoroughly explains the simple working of the system.

ADAPTABILITY OF THE GISHOLT LATHE.—This is the title of a leaflet issued by the Gisholt Machine Co., Madison, Wis., on which is illustrated the range of work that may be finished on these lathes. The description and cuts incidental to the finishing of a twin cylinder for an automobile engine are of much interest.

LOCOMOTIVE SUPERHEATERS.—The advantages of superheating are well presented in a pamphlet issued by the Locomotive Superheater Co., 30 Church St., New York, in which the company's types A, B and C superheaters are fully described and illustrated, and much valuable information is presented in concise form relative to the general question of superheating.

FLEXIBLE TRANSMISSION.—Bulletin No. 22, issued by the Coates Clipper Mfg. Co., Worcester, Mass., presents largely through illustrations, which are self-explanatory, the variety of uses to which flexible power transmission can be applied. The book contains 66 pages and over 100 fine cuts of the tools manufactured by the company and their method of application.

LEATHER BELTING.—"The Difference Between Albeco Laminated and Multi-Lap Leather Belting" is the title of a booklet being distributed by the American Laminated Belting Co., 113 Hudson St., New York. This booklet is especially interesting in that it gives close comparisons of the operating principles, power transmitting qualities and ultimate economy of both types of belting.

HORIZONTAL CENTER CRANK ENGINES.—Bulletin 182 of the Sturtevant Engineering Series, issued by B. F. Sturtevant & Co., Hyde Park, Mass., describes the H. C. 1 horizontal center crank engines, and contains interesting and valuable tables covering net horsepowers, etc. The bulletin also includes a lettered diagram and table of principal dimensions for engines of all sizes in class H. C. 1.

HEATING AND LIGHTING.—The Safety Car Heating and Lighting Co., 2 Rector St., New York, commenced the issue, October 1, of a new publication called "The Safety Heating and Lighting News," the object of which is to place before railroad men matters of interest relating to lighting and heating railroad cars and allied subjects. The contents of the initial number have been carefully selected and it contains much interesting matter on these important subjects.

ELECTRIC LIGHT AND POWER MACHINERY.—A very attractive souvenir bulletin of the inspection trip of Cincinnati's commercial organizations to the new plant of the Triumph Electric and the Triumph Ice Machine Companies, Cincinnati, O., on April 30, 1910, is now being distributed. In addition to an account of the inspection proceedings, the book contains a history of the company and is beautifully illustrated with photographic reproductions of interesting views about the plant.

STANDARD SPECIFICATIONS.—The Carnegie Steel Co., Pittsburg, Pa., has issued a very valuable pamphlet under the above title, which covers comprehensively and in compact form the standard specifications for structural steel, special plate and rivet steel, building, bridge and ship material, concrete reinforcement bars, forgings, axles and wheels, and structural nickel steel, as adapted by the Association of American Steel Manufacturers, the Carnegie Steel Co. and the American Society for Testing Materials.

TRAIN LIGHTING.—Bulletin No. 4769, issued by the General Electric Company, Schenectady, N. Y., entitled "Train Lighting with G-E Mazda and Tantalum Lamps," should be of interest to all connected with this branch of transportation. Owing to the high efficiency of these lamps they are admirably adapted to this service, while the strong filament of the Tantalum and the flexible mount of the Mazda filament renders them capable of withstanding the sudden jars and shocks incident to railway service.

BOLT THREADING AND TAPPING MACHINES.—This subject is thoroughly covered from a productive standpoint by the Webster and Perks Tool Co., Springfield, O., in a 30 page catalogue, which fully describes and illustrates the line of bolt pointing, threading and special tapping machines manufactured by that company. The catalogue calls particular attention to the many very material improvements and additions to the line of horizontal threading and special tapping machines which have followed since the inception of the company's business in 1891, and a very cleverly arranged half-tone plate is included, illustrating the wide range of work of which these machines are capable. The catalogue also contains tables of speeds for cutting bolts and tapping nuts, and other information of value to those interested in this machinery.

NOTES

THE T. H. SYMINGTON CO.—On November 1st the Chicago offices of this company will be moved from Railway Exchange to Suite 623-625 People's Gas Building.

WELLS BROTHERS CO.—In mentioning last month the removal of this company from 126 Chambers St., New York, to 90 Worth St., the latter address should have been 90 Centre St., where a full and complete stock of screw cutting machines will be carried.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.—This company has received from the Boston and Maine R. R. a contract for the entire equipment in connection with the electrification of the Hoosac Tunnel, under the Hoosac Mountain, in Massachusetts.

TRIUMPH ELECTRIC CO.—The above company of Cincinnati, O., announces the following change in address and management of its Chicago offices: W. R. Bonham succeeds F. L. Merrill, as manager, and is located at No. 275 La Salle St., instead of in the Manhattan Building as formerly.

MCKEEN MOTOR CAR CO.—The Southern Pacific Ry. has placed an order with this company for one 70-ft. motor car, and it will build a similar one for the Rock Island lines. It has also recently delivered a 70-ft. gasoline motor car to the Chicago Great Western Ry. for service out of St. Joseph, Mo.

BURTON W. MUDGE & CO.—This company, of Chicago, Ill., has elected Robert D. Sinclair, secretary and treasurer. Mr. Sinclair, in accepting this position, retired from one of the most responsible positions in the First National Bank of that city, with which institution he had been connected for many years.

ATLANTIC WORKS, INCORPORATED.—It is announced from the Philadelphia office of this firm that Thomas T. Power, James J. Power, and Lawrence C. Power, of the firm of L. Power & Co., Philadelphia, Pa., have purchased control of all the stock of the above corporation, and in the future will assume complete charge of all its affairs.

BALDWIN LOCOMOTIVE WORKS.—C. H. Peterson, hitherto connected with the Chicago office of the Baldwin Locomotive Works and the Standard Steel Works Co., has been appointed Southwestern representative of these companies with office at 914 Security Building, St. Louis, Mo. Edward B. Halsey, who has been in charge of the St. Louis office, has been transferred to the sales department of the Philadelphia office.

GALENA SIGNAL OIL CO.—Recent government tests of this company's improved oil for locomotive headlights, known as Galena Railway Safety Oil "B," show it to produce, with headlights of ordinary construction, a minimum of 1,800 candle power. In the instance of a headlight equipped with sixteen-inch optical lens, costing no more than the initial cost of the ordinary reflector, and much less for maintenance, the minimum candle power increased to 2,400.

GISHOLT MACHINE CO.—It is mutually announced by this company of Madison, Wis., and the Joseph T. Ryerson and Son, Chicago, that an association of interests has been formed in the manufacture and sale of machinery and machine tools. Extensive additions will be made at once to the Gisholt plant which will greatly increase the output of that company, and permit of development which the association of one of the leading machine tool builders with a strong machinery organization would seem to prophesy.

J. G. WHITE & CO.—This firm of engineers and contractors, New York City, has been awarded a contract by the New York, Ontario & Western Railway Company for the erection of railroad shops at its Mayfield yards, Mayfield, Pa., near Carbondale. The work to be carried out consists of a ten stall roundhouse, with a 75-foot turntable, machine shop, carpenter shop, with complete power plant; storehouse, office building, oil building, sand storage, drier and loading house; and a complete coaling station, with a storage capacity of approximately 1,000 tons. The buildings will be of the usual type of brick and steel construction. The estimated cost is approximately $150,000.

An Excellent Locomotive Terminal

THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD COMPLETED ABOUT SIX MONTHS AGO AT CORNING, NEW YORK, A LOCOMOTIVE TERMINAL CONSTRUCTED FROM THE PLANS ADOPTED AS STANDARD AFTER SEVERAL YEARS' INVESTIGATION AND STUDY OF THE SUBJECT. OTHER TERMINALS THROUGHOUT THE SYSTEM HAVE BEEN AND ARE BEING CONSTRUCTED FROM THE SAME STANDARD PLANS.

In many ways the facilities provided for properly taking care of locomotives in service are the most important under the motive power department's jurisdiction and in fact at times are the most important features of the whole scheme of operation. That this fact is thoroughly appreciated by the officials of the New York Central Lines is clearly evidenced by the character of the terminals, which are now being erected. The beginning of the movement for uniform high class locomotive terminals on this road dates back a number of years to the appointment of carefully selected committees who gave the whole subject the most careful investigation and study, and whose reports were most thoroughly discussed by all of the departments interested; sufficient time and attention being given to the subject to permit thoroughly satisfactory compromises on points where there was a difference of opinion between the different departments.

Following this preliminary work standard designs were drawn up in so far as it was possible to do so. These standards were, of course, arranged to have sufficient flexibility to allow for the varying demands of different points and include such matters as section of the enginehouse, diameter and type of turntable, heating system, lighting, construction of pits and floors, cinder pits, general track arrangement, type of architecture, etc. It has been found advisable to change the original standards in a number of small details after experience, but in general they are the same as were originally adopted and from them five or six terminals of various sizes have been constructed and others are in the process of being built.

At Corning, N. Y., on the old Fall Brook Road, a new location was selected for the yard and the terminal which accompanied it forms probably the best example of the standard construction and is a practically ideal locomotive terminal of its size.

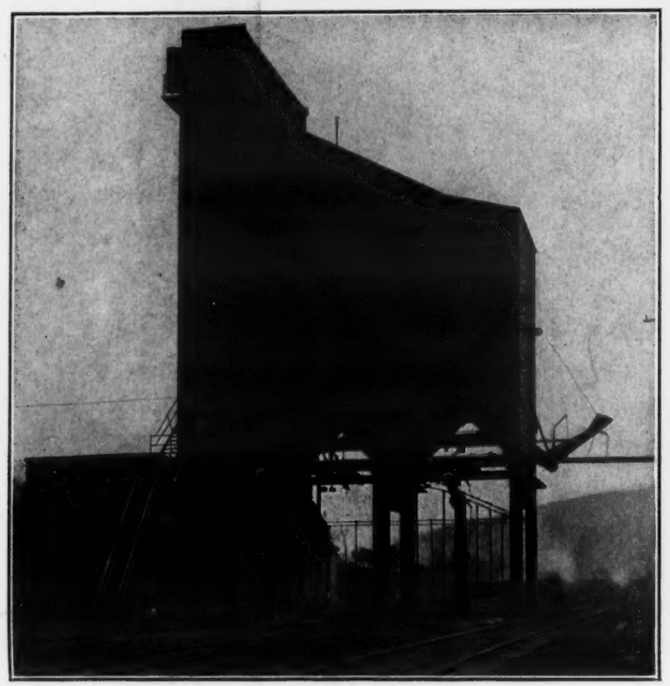
The traffic on this road consists very largely of coal and is such as to require the turning of 80 locomotives in 24 hours on an average. These are principally of large consolidation type. Although the enginehouse has 30 stalls, six of these are in the drop pit section and are used ordinarily for light repair work, leaving but 24 stalls for terminal service. On the basis of 80 engines every 24 hours, this gives an average of seven and a quarter hours for each engine to remain in the house. Since practically all of the crews have regularly assigned engines and the crews have at least eight hours rest, storage tracks are provided for holding the locomotives that are waiting for their crews.

GENERAL VIEW OF THE NEW LOCOMOTIVE TERMINAL ON THE NEW YORK CENTRAL LINES AT CORNING, N. Y., TAKEN FROM THE TOP OF THE COALING STATION

Reference to the general plan of the terminal on page 463 will show that when incoming engines entering from the left are abandoned by their crews near the coaling station, the crews,

VIEW SHOWING ELECTRICALLY OPERATED TURNTABLE AND EXCELLENT TURNTABLE PIT

GENERAL INTERIOR VIEW SHOWING ROOF TRUSSES AND ELECTRIC LAMPS



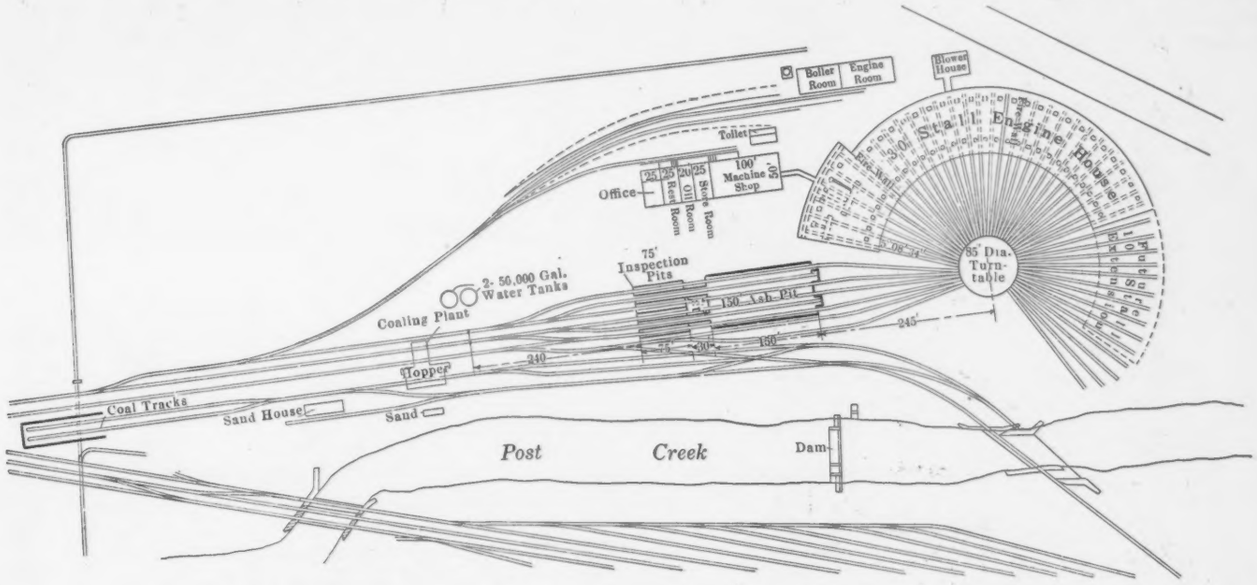
REINFORCED CONCRETE COALING STATION

HOT WATER WASHING AND FILLING SYSTEM—CONNECTIONS IN THE ENGINEHOUSE

PITT BALANCED ENGINE HOUSE DOORS

checking their oil cans, tools, etc., in the small building provided for the purpose near the coaling station, walk down to the inspection pits and deliver their work report. A hostler takes the locomotive at this point, coals, sands and waters it and places it upon the inspection pit, whereupon he returns for another engine. After being inspected another hostler takes it to the ash pit adjoining and after the fires are cleaned puts it into the enginehouse. Although four inspection and four ash pits are shown in the drawing but three have been constructed for the present. The arrangement at the coaling station is such that coal and sand are taken at the same time on any of the three tracks and the water cranes are far enough away to allow an engine being coaled while another is taking water.

In addition to the enginehouse and coaling station there are



TRACK ARRANGEMENT AND LOCATION OF BUILDINGS AT CORNING LOCOMOTIVE TERMINAL

three other buildings of importance in connection with the terminal; one measuring 50 ft. in width and 195 ft. long, houses a machine shop 50 by 100 ft., a storehouse 25 by 50 ft., an oil room 20 by 50 ft., an engineers' rest room and a general foreman's office. Another building contains the power plant and a third is the blower house, which is connected to the enginehouse by a covered passageway. The bird's-eye view on page 461 shows the general appearance and relative size of these structures.

A study of the track arrangement will show that all possible contingencies of operation have been provided for. Most of the outgoing locomotives pass over the bridge to the right and suitable tracks are provided for this switching movement, so as to prevent all possible interference in case of accident. Arrangements are made to pass the locomotive directly from the coaling station to the house without going on to the cinder pit and also to get one locomotive ahead of another after it leaves the coaling station, if so desired. In studying this track arrangement it should be remembered that practically nothing but freight and switch engines are housed at this point.

COALING STATION.

For its capacity the coaling station at Corning is a model of its kind. The structure is of reinforced concrete throughout and the coal pockets have a storage capacity of 300 tons. It is of the original balanced bucket or Holman type and is operated by electric power. The locomotives take coal on three tracks, two directly below the bins and one at the outside. Reference to the photograph shows the general appearance of the station, which has an extreme height above the rail level of 76 ft. 3 in. The width of the section containing the pockets is 22 ft. The elevator section is 31 ft. 8 in. in width and the receiving hopper and hoist sheds are extensions from this.

Reference to the general plan of the terminal will show the track arrangement for the storage of loaded and empty coal cars. The receiving hopper is 36 ft. long, located at one side of the station proper and is covered with a concrete canopy, the loaded cars from the storage tracks being run down over it largely by gravity. Hopper bottom cars are used altogether for the coal supply and they discharge upon a grating of ¾ x 4 in. bars spaced 15 in. apart in both directions, through which the coal passes to a revolving feeder at the bottom of the hopper. This feeder measures the charge of coal delivered to the elevator buckets and prevents the overfilling of the buckets and the spilling of the coal into the bucket pit. The buckets are automatically loaded and unloaded, and are of 1½ tons capacity each. They are designed to be operated at such a speed as to give an elevating capacity of 75 tons per hour. Actually, however, the plant has shown itself capable of elevating 50 tons in less than one-half hour.

No provision is made for weighing the coal, except as it is weighed in the car and the amount delivered to each locomotive is estimated altogether by the appearance of the tender. With this exception it is probably the most thoroughly equipped plant in the country. It is electric lighted throughout and is provided with automatic features to prevent any possible accident. The hoisting drum is operated by an electric motor of the induction type and limit switches are provided to prevent overwinding of the cable. Steel stairways and gangways are arranged to give easy access to all parts of the structure.

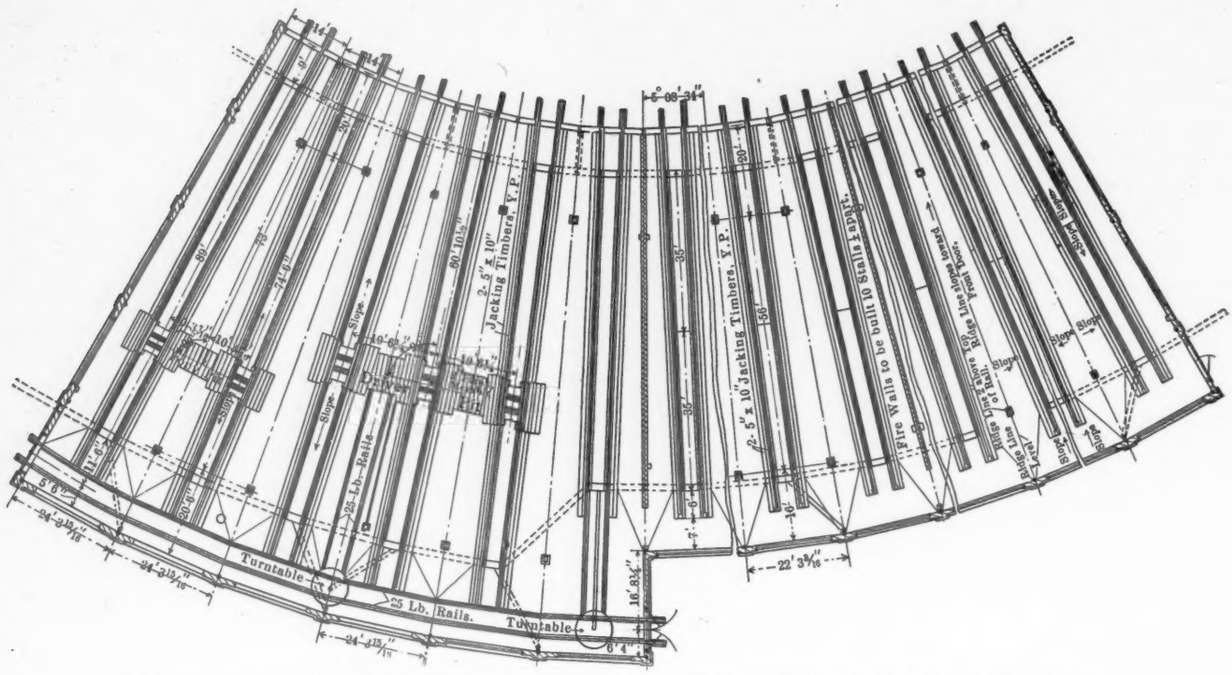
An unusual provision and one of decided value in cold climates is found in the steam coils around all of the gate openings; underneath the feeder in the receiving hopper and in the bucket pit; in the motor house; in the top of the monitor and other places where needed. These coils keep the station throughout at a temperature considerably above freezing and greatly assist in its reliable operation under all conditions.

In addition to the coal storage there are two concrete bins above the coal pockets for the storage of dry sand, with discharges leading to each of the three tracks, so that sand and coal can be taken at the same stop. The sand is dried in a separate structure near the coaling station and is elevated by means of compressed air in the usual manner.

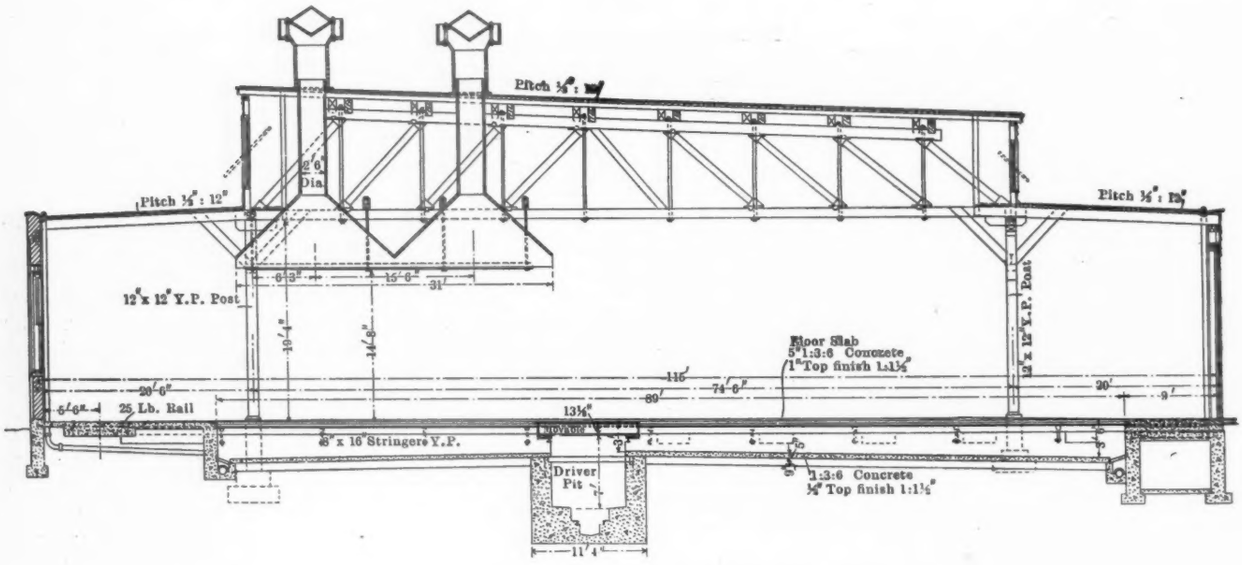
This coaling station throughout was designed and built by the Roberts and Schaefer Co., of Chicago, and is an excellent example of the type of station this company is constructing at various points throughout the country.

INSPECTION AND ASH PITS.

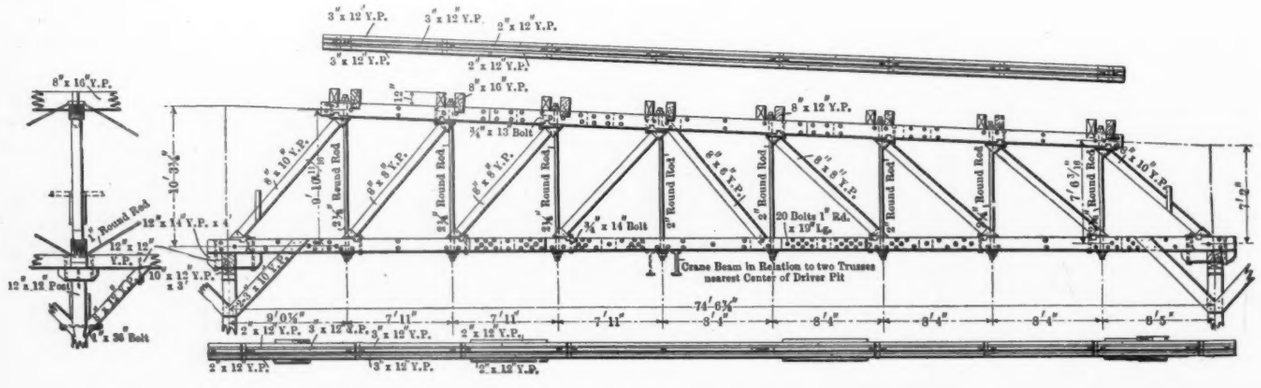
The inspection pits are 75 ft. in length, constructed of concrete with the same general dimensions as the pits in the roundhouse. They are provided with steps at either end. Pending



PLAN OF A SECTION OF THE ENGINEHOUSE—THIS CONSTRUCTION IS STANDARD ON THE NEW YORK CENTRAL



SECTIONAL ELEVATION OF THE STANDARD 115 FT. SECTION FOR ENGINEHOUSES ON THE NEW YORK CENTRAL



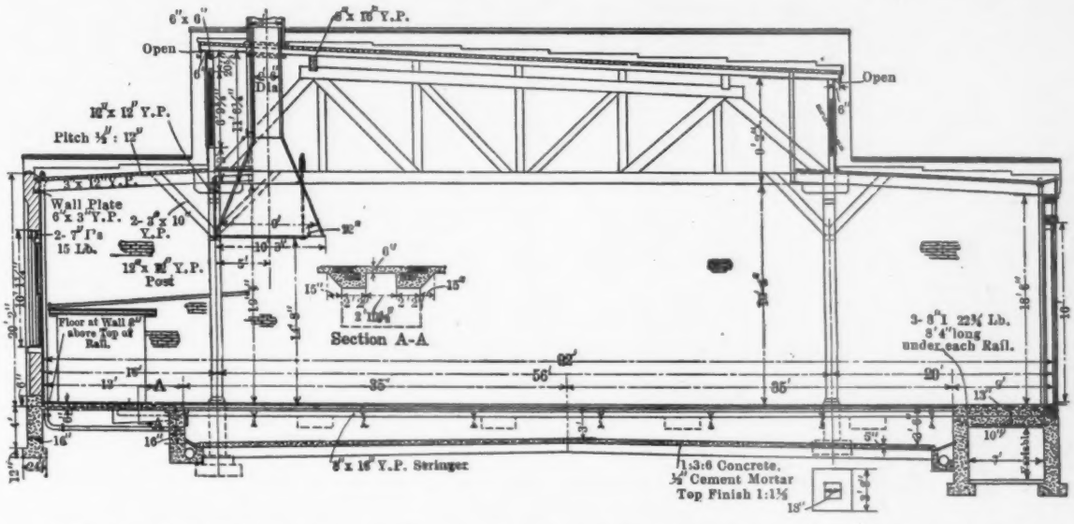
DETAILS OF THE ROOF TRUSS IN THE 115 FT SECTION OF THE ENGINEHOUSE

the construction of the fourth pit a temporary wooden structure has been provided for the inspectors.

The ash pits are 150 ft. in length and are of the shallow shovel type that has been adopted as standard on this road. Two depressed tracks serve the four pits. These pits are also constructed of concrete, the rails being carried by cast-iron chairs, allowing the pit to extend some distance beyond the outer rail and a wide shoveling platform between the inner rail and the depressed track.

TURNTABLE.

A standard 85 ft. electrically driven turntable is provided, the motor being of the induction type, driving through clutches in the usual manner. The construction of the pit and the general appearance of the track is clearly shown in one of the illustrations. The top of the concrete wall is capped by two inverted rails, which distribute the blow on the end of the track rails. The pit is floored with concrete, insuring good drainage and preventing any heaving of the circular track or the side walls from frost.



SECTIONAL ELEVATION OF THE STANDARD 92 FT. SECTION FOR ENGINEHOUSES ON THE NEW YORK CENTRAL

ENGINEHOUSE STRUCTURE

The illustrations on this and facing page, together with the various photographs, clearly show the arrangement, size and construction of the enginehouse itself. This construction is from the same standard plans, with a few changes in detail, that were used at the West Springfield house, illustrated on page 5 of the January issue of this journal. All of the foundations are, of course, of concrete and the outside walls are of brick. The major portion of the roof structure is carried by a wooden truss 56 ft. in length, supported by two rows of 12 by 12 in. yellow pine posts. The sections outside of these posts are supported by 3 by 12 in. rafters, the pitch being 1 in 24. It will be noticed in connection with the roof that the gutters drain through leaders placed inside of the wall, which prevents their freezing and the formation of ice on the roof or side walls. These leaders drain into the pits and from there to the sewer. The upper section of the roof inclosing the trusses, has large swinging windows along both sides which are operated from the floor. Six inch openings under the cornice at either end of this section will be noticed, which experience has shown greatly assists the ventilation. In fact, even with the windows in the upper section closed this opening together with the three inch annular space around the smoke jack keeps the house reasonably clear of steam and gases. When the upper windows are also opened the ventilation is practically perfect. This high open roof construction gives excellent natural lighting at the centre of the house. For the purpose of housing the drop pits, and to provide ample room for all necessary movements over the drop pits, the section of six stalls at one end of the house is 115 ft. inside measurement instead of 92 ft. as in the rest of the structure. In this part a somewhat more elaborate roof truss with iron tension members has been provided and is shown in one of the illustrations. This section also provides two smoke jacks over each pit, giving a 31 ft. movement before the stack is out from under a jack. In other respects the longer section is of the same general construction as the rest of the house.

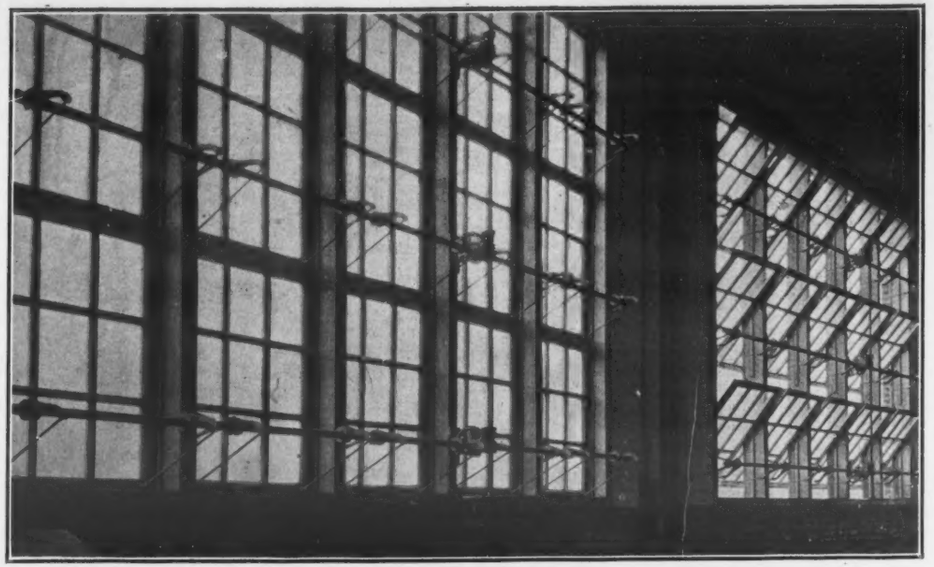
Pits.—The pits in the main portion of the house are 70 ft. in length and 3 ft. in depth at the centre, sloping both ways to a depth of 3 ft. 6 in. The concrete side walls are capped by a 5 x 10 in. timber, bolted to the concrete, to which the running rails are spiked. The concrete foundation is also carried out sufficient to form a support for two 5 by 10 in. timbers placed side by side outside of the rails, which give a perfect foundation for jacks. All of the hot air for heating emerges from eight points, four on either side of each pit, the hot air conduit of concrete being located just at the inner ends of the pit, as is shown in the sectional view. The bottom of the pits is of concrete finished with a ½ in. coat of hard cement mortar.

Floors.—Concrete floors 6 in. thick, capped by ½ in. hard cement mortar finish are used throughout the house. Reference to the plan will show the method of drainage, which is arranged to give a good slope and drains from all directions toward the pits. The foundation of the outer wall is carried up several inches above the floor level, so as to prevent seepage of water under the wall at this point.

A full gauge industrial track of 25 lb. rails, with two turntable connections inside the house and a connection to the track leading into the shop will be seen on the plan. This is only provided in the drop pit section.

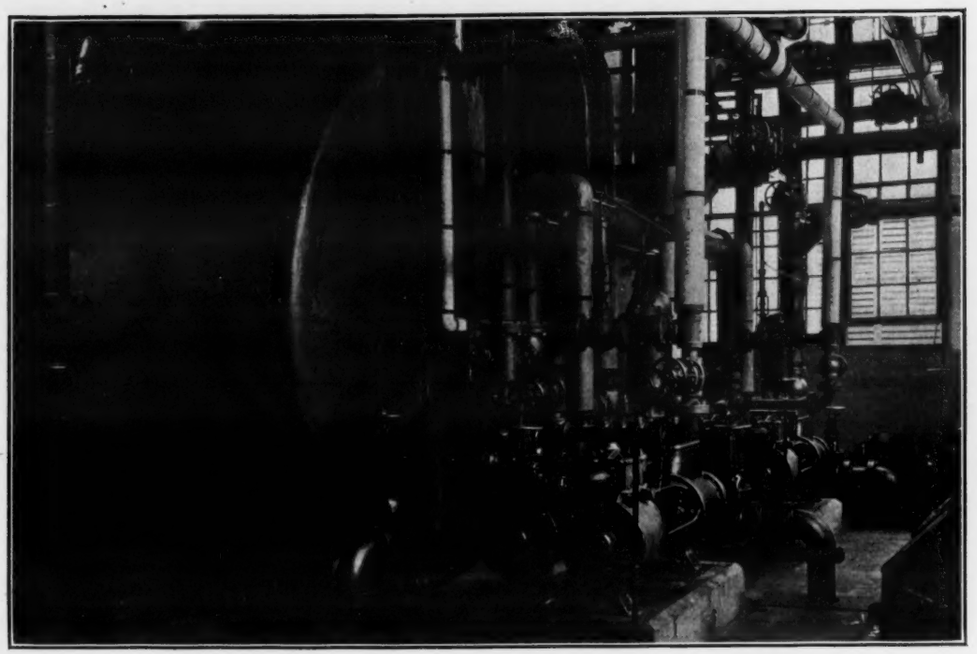
Windows.—One of the illustrations on page 466 gives a view of the windows in the outer wall. It will be seen that each large window is comprised of 15 hinged sash of nine panes each. All of the sash in each set are swung by one operating gear arranged as is shown in the illustration. The windows in the outer wall are 15 ft. 10 in. in length and practically 9 ft. in height. In the louvre the windows in the outer circle have 5 sash, each having eighteen 10 by 12 in. panes of glass and measuring 6 ft. 6 in. in height and 15 ft. 7 in. in width, while those in the inner circle are 4 ft. 4 in. in height and 12 ft. 5 in. in width, there being but four sash in this group, each having twelve 10 by 12 in. panes. In addition to these there are eight standard sash of six lights each in the doors. As can be easily imagined and is clearly shown in the interior views of this house, this gives an excellent natural lighting. The window operating gear throughout the whole plant was furnished by the Dearborn Hardware Co., of Chicago. The artificial lighting will be mentioned later.

Smoke Jacks.—The smoke jacks are moulded from Transite



WINDOWS AND OPERATING GEAR IN THE ENGINEHOUSE

A SECTION OF THE MACHINE AND FORGE SHOP

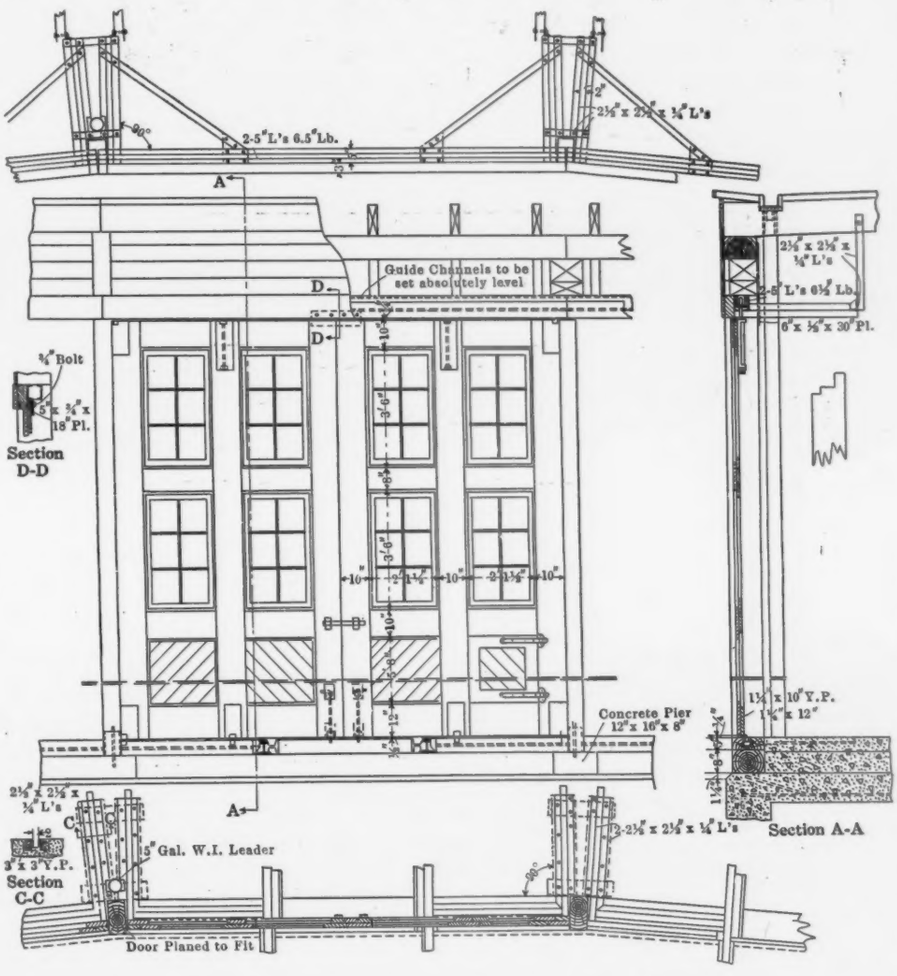


PUMPS, PART OF TANKS AND CONNECTIONS FOR THE HOT WATER WASHING AND FILLING SYSTEM

GENERAL VIEW OF ENGINEROOM IN THE POWERHOUSE. AIR COMPRESSOR AT RIGHT AND PUMP PIT AT LEFT

asbestos wood, a mineral product proof against the effects of acid, gases, fumes, and climatic conditions and absolutely fire proof. This material is moulded over forms and shipped in sections that are drilled ready for erection. After being installed the bolts, nuts, and washers are coated with Transite cement to protect them against corrosion. This material offers many advantages for this purpose and while it is absolutely fire proof it can be worked much the same as hard wood and has a tensile strength practically equal to hard wood. It is very light and does not require special roof construction to support it. The material does not collect condensation and is not affected by expansion and contraction.

The single jacks have a length of 9 ft. and narrow up to a circular section 2 ft. 6 in. in diameter, which continues to a point slightly above the roof line. Outside of this and resting upon the roof, leaving a 3 in. annular opening between the two sections, is a 3 ft. circular section, arranged as is shown in the cross section of the 115 ft. part of the house. These jacks have wings extending down 12 in. on each side, preventing a clear sweep across the top of the stack, tending to blow the smoke out into the house. In the drop pit section two of these jacks are provided over each pit, being arranged as is clearly shown in the illustration. All of the smoke jacks are supported from the roof truss, which is designed to give ample strength for this purpose. The jacks were designed by the railroad company and manufactured by the H. W. Johns-Manville Co., of New York.



DETAILS OF THE PITT BALANCED DOOR FOR ENGINEHOUSES

Drop Pits.—Drop pits for driving wheels are provided covering three tracks and for truck wheels covering two separate tracks. There is one track in this section of the house that is not provided with a drop pit of either kind. These pits are provided with the usual telescopic air jack and a noticeable feature is the 12 electric lights in each of the driving wheel pits, these being located in recesses in the side walls, so as to be perfectly protected. The pits are, of course, of concrete throughout and the openings between the tracks are covered with 3 in. planks, which are easily removable. Over the driving pits there is a trolley hoist carried from the roof trusses.

One of the illustrations gives a detailed view of the moveable rail used on these pits, which is considerably more elaborate and satisfactory than is customary. This section of the rail is carried by a girder built up of steel channels and angles, which is provided with small wheels set at the proper angle on to which the weight of the girder can be thrown by means of eccentrics, operated by hand. When the moveable rail is in its normal position the girder is carried on bearing plates at each end, but when it is desired to move it, it is lifted slightly by throwing the weight on to the small wheels, when it can be easily pushed to one side for any desirable distance. The same design of moveable rail is also used in the truck drop pit. As noted above, the drop pits are in a section of the house made 23 ft. longer than that used elsewhere. This practice is standard on the New York Central, where it originated and very materially adds to the usefulness of the house. The greater length available not only gives a greater range of movement for the locomotives on the pits, enabling any wheel on any engine to be removed, but provides the room needful for the shop work, which is the real purpose of providing the drop pits.

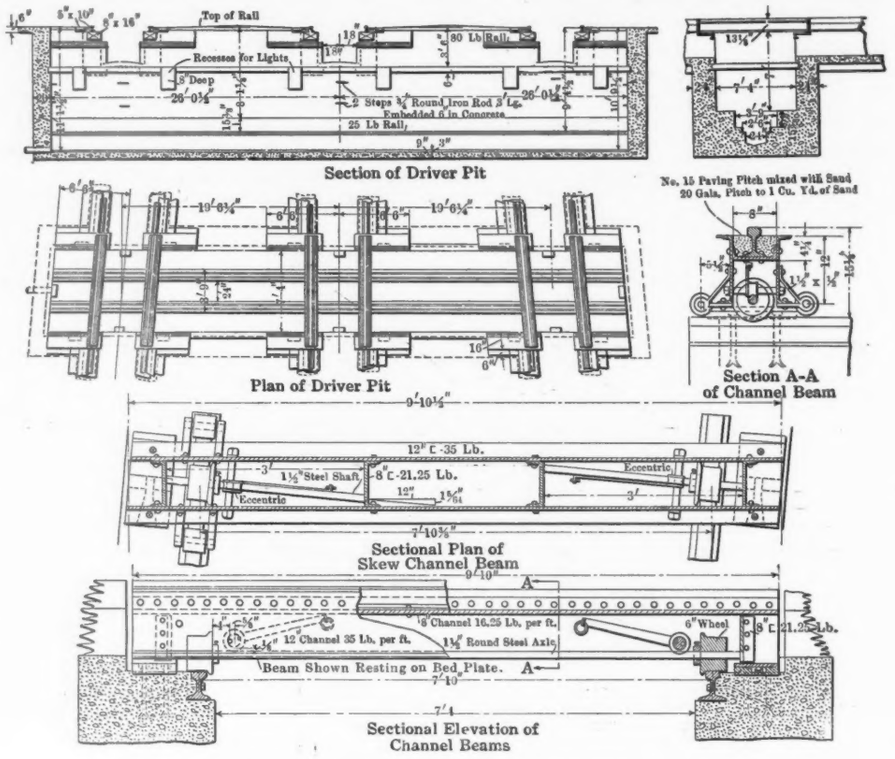
DOORS.

In climates where cold weather, accompanied by high winds and heavy snow fall, is found there is probably nothing throughout the whole locomotive terminal that is more vexatious than the usual heavy swinging enginehouse doors. Many different schemes to avoid this trouble have been applied and at Corning an entirely new design of door is found. This consists of an adoption of the design that has been applied to car gates, doors of telephone booths and in public buildings by the Pitt Balanced Door Co., of New York. The arrangement is such that a combination swinging and sliding motion is provided so that the doors when fully opened extend half of the width inside of the door opening. Inasmuch as with this type of construction the whole weight of the door is carried from a single set of rollers in the centre at the top of each door it is possible to use a decidedly lighter construction than when hinges are employed, greatly assisting in the ease of opening and closing.

This arrangement seems to offer many advantages for enginehouse uses. It permits the installation of the large lighting area so desirable in enginehouse doors. It increases the clearance, allowing the tracks to be set closer together at the inner circle; the large rollers running on an iron track give an easy operation and considerably less snow clearing is required. Doors of this type practically cannot be blown closed with resulting damage to windows and frame work. Because of the lighter construction they are much less liable to warp and swell and because of the substantial top support there is no difficulty with binding at the bottom when the frost heaves the track at this point.

Reference to the illustrations will show the design and operation. The overhead track consists of two 5 in. L's and the interior guides set at 90 degs. with this track are composed of 2½ in. L's, the inner end being supported directly from the roof timbers. The carriage supporting the door at the centre has four running wheels and a horizontal guiding wheel, which insures its easy operation. At the bottom are two guiding pins sliding in slots in the floor, one of these in the centre directly below the roller carriage and the other at the inner corner directly below a similar guide at the top. In operation when the door is pushed outward in the usual manner the side next to the post swings inward guided by the pins and slots as just explained, turning about the support from the roller carriage. As pressure is continued the roller carriage moves toward the post, the inner side continuing to swing inward until full open, when each door is half in and half out of the house lying close against the post and parallel to the track.

While this enginehouse has not yet been through a full winter, the experience of early spring and summer has indicated the entire suitability of the design for this purpose, and while there may be anticipated some trouble with the lower slots filling up or with corrosion of the metal work overhead, it is not believed that this will prove serious. The slots are provided with ample clearance at the ends and any trouble with ice forming can be eliminated by filling the slot with a heavy oil. Constant operation will probably prevent any serious trouble from corrosion of the working parts.



DETAILS OF DROP PITS AND MOVEABLE RAIL

HEATING AND LIGHTING.

After a thorough investigation of the subject and the completion of extended trials under the most difficult conditions, the New York Central Lines have adopted the hot air system of heating for enginehouses. The air is conveyed through the house by means of a large concrete duct or tunnel, running around the circle at the inner ends of the pits. At Corning this tunnel is 7 ft. in width and of a varying height, depending upon the area needed. From it is carried out between each of the pits a branch which has four outlets in the sides of each of the adjacent pits, equally spaced throughout its length. Each of the outlets in each of the pits is fitted with dampers. Particular attention has been given to the perfect drainage of this heating conduit and it is provided with no outlets except those in the pits.

In the case of the Corning enginehouse the blower is located in a separate building connected to the enginehouse by a covered passageway. The apparatus is in duplicate, both fans discharging into the large conduit, which is 7 ft. by 7 ft. in section at this point. The heating apparatus was furnished by the Bailey Mfg. Co., of Milwaukee, and each of the two sets consists of a 11 ft. fan 54 in. wide, having a capacity to deliver 88,800 cu. ft. of air per minute at 150 r. p. m. The fans are driven by a 10 by 12 in. horizontal engine direct connected. With each fan there is a heater having 5,000 sq. ft. of heating surface and the whole apparatus has been installed under a guarantee to give 65 degs. temperature in the house with an outside temperature of 10 degs. below zero.

It will be seen that at normal capacity these fans are capable of delivering 177,600 cu. ft. of air per minute, or sufficient to completely change the air in the whole enginehouse every 8 minutes. The effect of this circulation upon the ventilation of the house can be easily understood and in other engine houses in very cold climates it has been found that this system of heating will maintain the guaranteed temperature with ease. With a 30 stall engine house, as at Corning, this apparatus gives 333 sq. ft. of heating surface per pit and a delivery of 5,920 cu. ft. of air per pit per minute.

In the machine shop, offices and other sections of the plant the heating is by direct radiation from steam pipes, the exhaust steam forming the principle supply for all of the buildings with the exception of the coal chute, although high pressure steam can be turned on if necessary. In the machine shop particularly, the large amount of heat radiating surface is very noticeable and because of the very liberal window area it will no doubt be found to be highly desirable in this climate. The radiators consist of from 12 to 15 rows of piping encircling the whole shop underneath the windows, with the exception of the door openings.

In the enginehouse the artificial lighting is by means of enclosed arc lamps, there being one suspended directly from the roof timbers in the centre of the house, between each of the pits. There are also a few stationary incandescent lamps on the fire walls and at other points. Sockets for portable electrics are located on each post between the pits in the outer row. Incandescent lanps set is recesses, as shown in the illustration, thoroughly illuminating the drop pits.

In the machine shop the lighting is by Cooper-Hewitt mercury vapor lamps, there being six of these evenly distributed and supported from the roof trusses. Lighting in other parts of the plant is by incandescent lamps for interior and arc lamps for exterior lighting. The illumination for the interior of the coaling station is particularly noticeable. All of the lighting is on 110 volt alternating current circuit.

HOT WATER WASH-OUT SYSTEM.

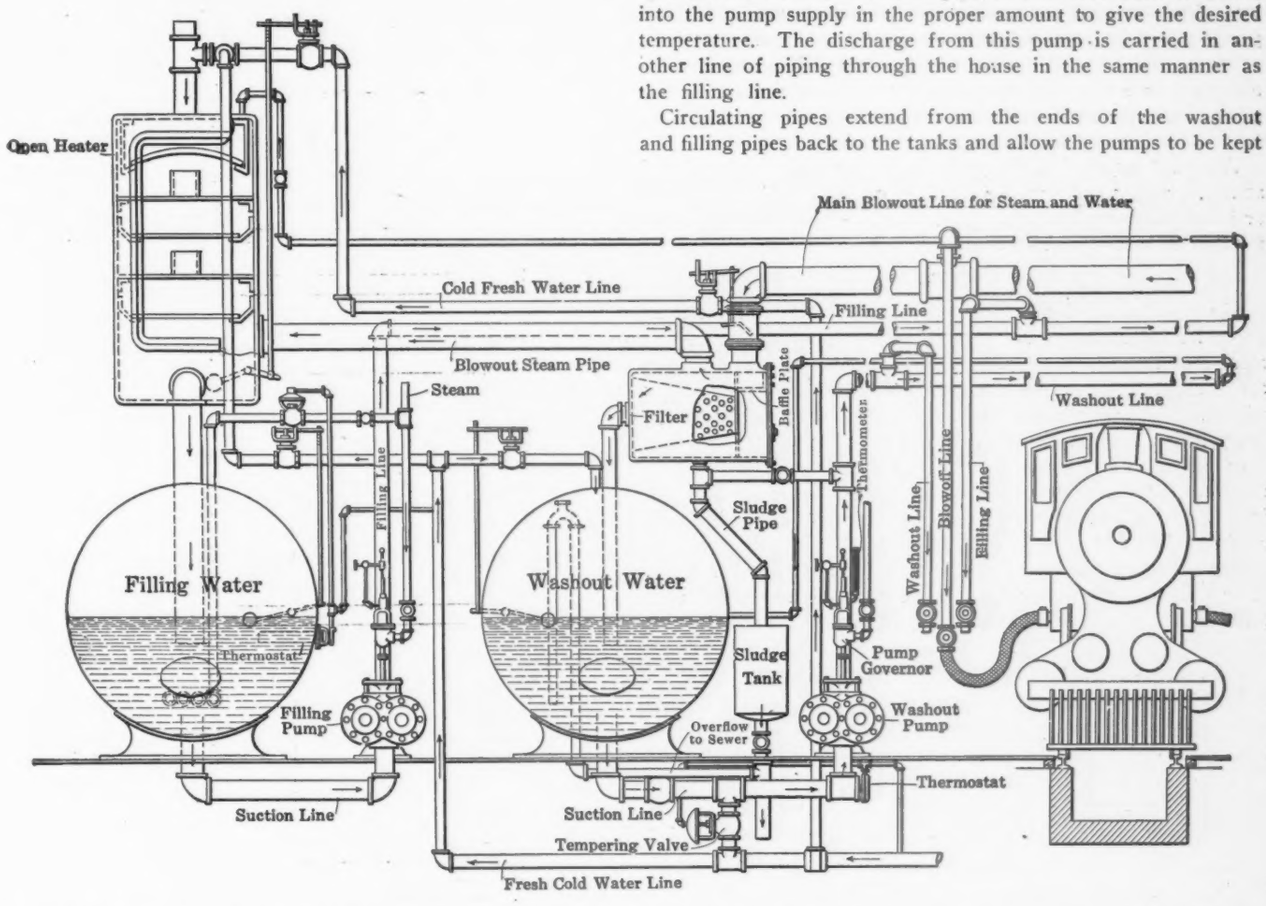
Recognizing the very great value of a hot water washing-out and filling system, not only as a time saver in turning locomotives but also as a means of reducing flue leakage and engine failure on the road, the New York Central Lines have installed systems of this kind in practically all of the enginehouses built in the past four or five years. Most of the equipments installed are of the same design as that at Corning, which was manufactured and

installed by the National Boiler Washing Co. of Chicago. One of the illustration shows, in diagrammatic form, the apparatus and piping connections as used by this system, in which the utmost care has been taken to make it thoroughly automatic in its operation and positive in its results. An investigation at the terminal under discussion showed that the engineer in the power house found it necessary to simply lubricate the pumps and occasionally blow out the sludge tank, and beyond this, no attention was needed, the pressures, temperatures, etc., being automatically maintained within narrow limits.

Referring to the diagram, it will be seen that a locomotive coming in to be washed out is first connected by a hose to the blow-off line, the plug for which is located on every alternate post of the inner circle. From this connection it discharges into the main blow-off pipe, which is carried from the roof timbers around the circle, as is shown in one of the photographs, continuing to the power house, where it discharges into a large closed filter. In passing into the filter it operates a flap valve, which in turn automatically opens a valve in the cold water line to the top of the open heater. The steam and water passing into the filter, hit a baffle plate, and the steam is deflected into the blow-off steam pipe to the open heater located above the filling water reservoir. Here the steam is condensed by the cold water and flows to the storage tank below. A thermostat in this storage tank controls a valve on the live steam line, and live steam is admitted to it whenever the temperature is below that desired, usually 170 to 180 degrees. As a matter of fact, this valve is seldom operated, as the steam from the blow-off water is usually sufficient to maintain the proper temperature. In this tank there is also a float connecting to a valve on the cold water line insuring a sufficient supply of water at the proper temperature for filling at all times. A large, powerful pump draws its supply from this tank and discharges it into the filling line that parallels the blow-off line in the circle around the house and has a drop pipe with a gate valve on the same posts between every two pits.

The blow-off water, after reaching the filter, passes through a cone inclosing filtering material, after which it is discharged into the washout water tank just below. The sludge and scale held back by the filter are discharged into the sludge tank, from which it can be washed into the sewer. The temperature of the water in the washout tank as it comes from the filter will be on an average of about 185 degrees, but as this is too hot to handle in a washout hose, an automatic device is provided for maintaining it at a lower temperature, usually about 130. A valve is placed in a connection between the fresh water line and the suction line for the washout pump and is controlled by a thermostat in this suction pipe, so that cold water is drawn into the pump supply in the proper amount to give the desired temperature. The discharge from this pump is carried in another line of piping through the house in the same manner as the filling line.

Circulating pipes extend from the ends of the washout and filling pipes back to the tanks and allow the pumps to be kept in slow motion all the time, not only maintaining the temperature in the long piping but also insuring the pumps being ready to act more promptly when needed. The filling pump has a capacity of 500 gal. per minute and the washout pump has a sufficient capacity to wash out three boilers at one time, maintaining a pressure of 90 lbs. The filling water tank has a storage capacity of about 12,000 gallons and the washout tank of about 8,500 gallons.



DIAGRAMMATIC ARRANGEMENT OF THE NATIONAL BOILER WASHING COMPANY'S SYSTEM FOR HOT WATER BOILER WASHING AND FILLING

POWER HOUSE.

A most completely equipped and conveniently arranged power house forms not the least important feature of the terminal. It is enclosed in a separate building of brick, conforming in architecture to the other structures, having steel roof trusses with a flat roof. The natural lighting is excellent, as is clearly shown in the interior view. The structure is divided into two parts, forming a boiler room and engine room, alongside the former being located the trestle from which coal is discharged directly to the floor in front of the boilers. Three 300 h. p. Heine boilers furnish steam for heating and power. They are hand fired and a brick stack 125 ft high provides the draft. In the engine room

are located two direct connected sets consisting of 150 h. p. simple engines and 150 kva. alternators, delivering 60 cycle current at 480 volts. A completely equipped switchboard, back of which are located the transformers, is provided in connection with this equipment. The current at full voltage is used for operating the various induction motors throughout the terminal, consisting of a 15 h. p. turn table motor, two 30 h. p. motors in the machine shop and two 22 h. p. motors at the coaling station. The current for lighting is transformed to 110 volts.

A two stage Ingersoll-Rand air compressor, with 1,100 cu. ft. free air capacity provides the compressed air for use throughout the terminal and the yards. Two automatic boiler feed pumps occupy one corner of the engine room and in the pump pit are located two vacuum pumps for the heating system and two large pumps for the service water system, a water presure of 70 lbs. being maintained on the line. The hot water boiler washing and filling equipment occupies one end of the engine room and these pumps are cross connected to be used for fire service. A Cochran feed water heater is also provided.

The force required in the power house consists of a chief and assistant, with one fireman and his helper, days, and one fireman and engineer at night; the heating equipment also being cared for by this same force.

SHOP.

The structure, 50 by 100 ft., enclosing the shop is of the same general construction as the enginehouse, with the exception that steel roof trusses are employed. The windows in this section are particularly large and the two lower sash are arranged for sliding. The upper group, however, are operated on the swinging principle by gear the same as in the enginehouse.

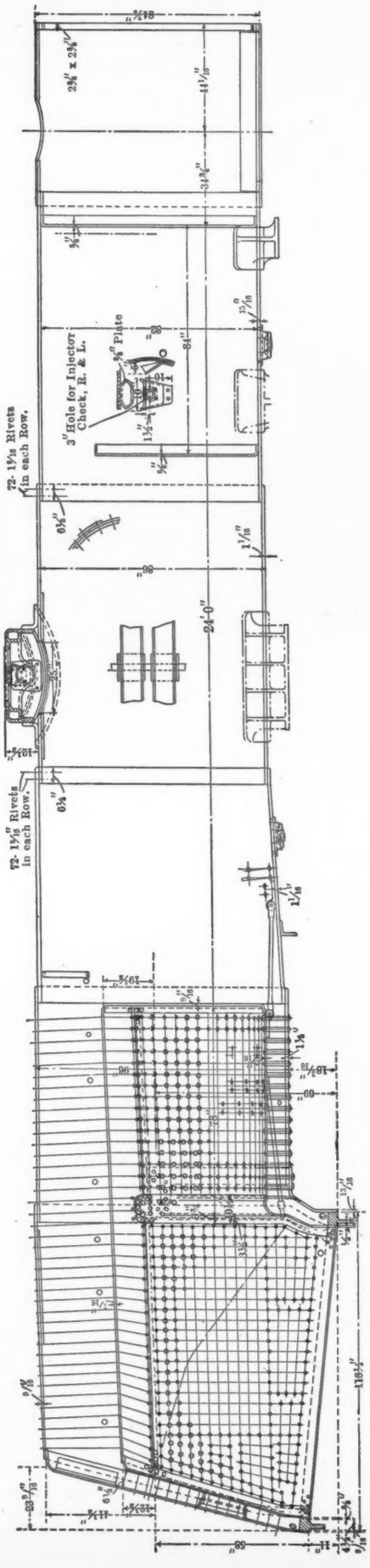
In this shop is located a practically complete outfit for light repairs. It includes two open forges with a steam hammer adjacent, small flanging clamp, flue cutter, hand rolls, together with auxiliary jib crane, anvils, ets., all grouped in one corner, providing excellent facilities for all usual forging or boiler work. Near this section are found a bench for tinsmith, provided with rolls, cutters, etc. In the same locality is also placed a large combination punch and shear.

The machine tool equipment includes, in addition to the above: A large planer, small planer, slotter, radial drill, shaper, driving wheel lathe, boring mill, hydraulic press, upright drill, four engine lathes swinging from 12 to 24 in., pipe threading and cutting off machine, double headed threading and tapping machine, bolt lathe and emery wheel. These machines are all belt driven from line shafting, driven by two 30 h. p. induction motors. The arrangement is such that either one or both of the motors can be used.

A covered passageway connects the shop with the drop pit section of the enginehouse and a track continuing through the centre of the shop provides connection between the two buildings. Air cranes are provided where required and the usual benches, vises and other small equipment is complete. The floor of the shop is of concrete, the same as in the enginehouse and the artificial lighting is by Cooper-Hewitt mercury vapor lamps. Numerous sockets for portable electric lamps are provided.

HOSPITAL

An unusual feature of this terminal is a very completely equipped small hospital, which adjoins the engineer's rest room. Owing to the fact that the hospital facilities of the village are about two miles away and the access to the enginehouse is somewhat difficult, arrangements have been made so that an injured person can be properly taken care of without being taken away in an ambulance. The equipment provides in a large light airy room, two hospital cots, an operating table with a complete outfit of surgical instruments, cold and hot water supply and all other facilities required by modern surgery. In case of accident the railroad surgeon is telephoned for and arrives either by a special engine or automobile and the injured man receives treatment within a very few minutes after the accident and that under strictly sanitary and satisfactory conditions. If he is very seriously injured it is not necessary to move him till he is in a condition to be safely taken to the regular hospital.

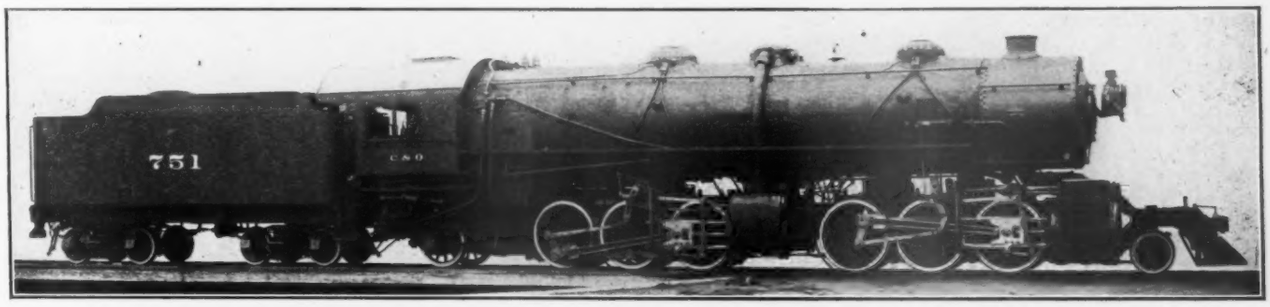


BOILER WITH A SIX AND A HALF FOOT COMBUSTION CHAMBER AND TWENTY-FOUR FOOT TUBES FOR THE CHESAPEAKE AND OHIO 2-6-6-2 TYPE LOCOMOTIVE

Mallet Locomotives for the Chesapeake & Ohio Railway

ABOUT SIX MONTHS AGO THE AMERICAN LOCOMOTIVE COMPANY FURNISHED A SAMPLE LOCOMOTIVE TO THE CHESAPEAKE & OHIO RAILWAY OF THE 2-6-6-2 TYPE DESIGNED TO SUIT SPECIAL CONDITIONS ON THAT ROAD. THE SERVICE WITH THIS LOCOMOTIVE HAS RESULTED IN THE PLACING OF AN ORDER FOR TWENTY-FOUR MORE OF THE SAME TYPE.

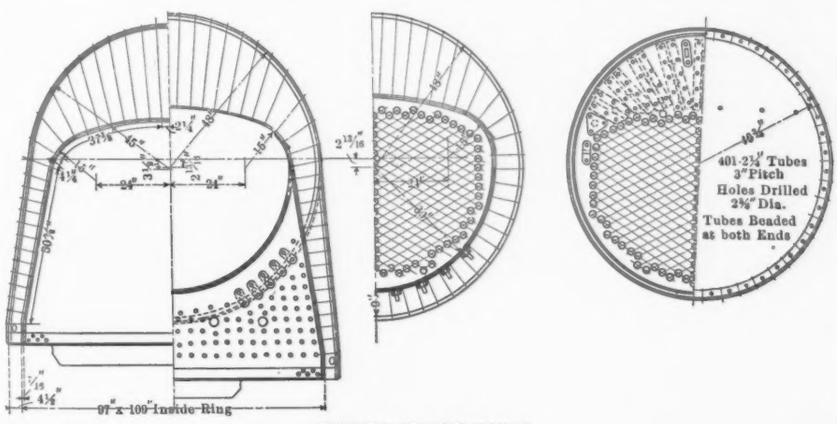
On the division of the Chesapeake and Ohio Railway between Handley, W. Va., and Allegheny, Va., east bound, there is for a distance of 106 miles a continuous easy up grade varying from 2¼ to 21 ft. per mile, the average for the last 68 miles of this being 19 ft. per mile. On the last 13 miles of the division going into Allegheny the grade is an average of 30 ft. per mile or .57 per cent. The freight traffic on this division has been handled by 2-8-0 type locomotives having cylinders 22 x 28 in., total weight of 190,300 lbs. and a theoretical tractive effort of 41,120 lbs. The American Locomotive Co. a sample engine designed for this service. This locomotive was delivered last July and was intended to handle 3,000 tons at a speed of 15 miles per hour on a grade of 21 ft. per mile or 12 miles per hour on a grade of 30 ft. per mile, combined with uncompensated curves of 5° 45′. This locomotive soon proved itself to be able to exceed its estimated capacity and has handled 3,492 tons eastward over the full division; and with a load of 3,033 tons, made up of 45 steel hopper cars, speeds of 20, 22 and 24 miles per hour have



MALLET LOCOMOTIVE THAT DRAWS 3033 TONS AT 22 MILES PER HOUR ON A GRADE OF 19 FT. TO THE MILE

rating with this class of engines was 1,800 tons, it being necessary to use a pusher on the 13 mile grade into Allegheny.

The value of heavier train units in reducing the cost of transportation lead the officials of this company to investigate the possibilities of more powerful motive power. In studying the subject it was found that a Mikado type locomotive suitable for the track conditions could be designed that would be capable of handling 2,250 tons over the division if the pusher service was still maintained on the heavy grade. While it was not of prime importance to eliminate the service of the pushers, it was desirable, and a design was then drawn up for a Mallet compound type of locomotive and it was found that an engine of this type suitable for the track conditions could be designed which would handle 3,000 tons over the full length of the division without assistance. In addition it was probable that this type of locomotive would handle the heavier train with even less coal consumption than the Mikado type would handle its tonnage.



SECTIONS OF THE BOILER

Following this investigation the company ordered from the American Locomotive Co. a sample engine designed for this service. This locomotive was delivered last July and was intended to handle 3,000 tons at a speed of 15 miles per hour on a grade of 21 ft. per mile or 12 miles per hour on a grade of 30 ft. per mile, combined with uncompensated curves of 5° 45′. This locomotive soon proved itself to be able to exceed its estimated capacity and has handled 3,492 tons eastward over the full division; and with a load of 3,033 tons, made up of 45 steel hopper cars, speeds of 20, 22 and 24 miles per hour have been maintained over the grades of 19 ft. per mile. This service has been so satisfactory that the company has now ordered 24 more locomotives of the same type.

In general the design of the locomotive follows the standards of the builders, which have been very thoroughly illustrated in these columns. In two respects, however, new features are introduced, this being particularly evident in the boiler, where a combustion chamber 6½ ft. long is incorporated. Other boilers have had combustion chambers, but so far our records show none of this size. By the incorporation of this construction it has been possible to bring the firebox back of the rear driving wheels, allowing a good depth of throat sheet being obtained without seriously interfering with the weight distribution. Ahead of the combustion chamber are flues 24 ft. long, which makes 30 ft. 6 in. from the fire box to the front tube sheet. A water space of 9 in. has been allowed between the combustion chamber and the shell of the boiler, to which it is stayed by radial staybolts. A baffle plate and tube support is located 7 ft. back of the front tube sheet, which prevents these very long tubes from vibrating to an excessive degree. This construction has been used in previous boilers designed by this company and illustrated in these columns.

Another departure from previous practice is noticed in the use of outside bearing radial trailing trucks, which are of a design similar to that used on the Pacific type locomotives. This arrangement gives a wider supporting base at the rear of the locomotive and tends to add decidedly to its stability. The leading truck is of the usual swinging bolster type.

That portion of the locomotive carried by the front group of wheels is supported by two sliding bearings, both of which are normally under load. The bolts connecting the upper rails of the

front frames with the lower rails of the rear group are provided with a coiled spring under the nut at the lower end, as has previously been used by these builders.

The general dimensions of the sample locomotive are as follows:

GENERAL DATA.	
Gauge	4 ft. 8½ in.
Service	Freight
Fuel	Bit. Coal
Tractive effort	82,000 lbs.
Weight in working order	392,000 lbs.
Weight on drivers	324,000 lbs.
Weight of engine and tender in working order	555,200 lbs.
Wheel base, driving	10 ft.
Wheel base, total	48 ft. 3 in.
Wheel base, engine and tender	80 ft.
RATIOS.	
Weight on drivers ÷ tractive effort	3.96
Total weight ÷ tractive effort	4.78
Tractive effort × diam. drivers ÷ heating surface	763.00
Total heating surface ÷ grate area	83.40
Firebox heating surface ÷ total heating surface, %	6.10
Weight on drivers ÷ total heating surface	54.00
Total weight ÷ total heating surface	65.30
Volume equivalent simple cylinders, cu. ft.	21.80
Total heating surface ÷ vol. equiv. cylinders	276.00
Grate area ÷ vol. equiv. cylinders	3.31
CYLINDERS.	
Kind	Mellin Comp.
Diameter	22 and 35 in.
Stroke	32 in.
VALVES.	
Kind, H. P.	Piston
Kind, L. P.	Slide
Greatest travel	6 in.
Outside lap. H. P.	1 in.
Outside lap, L. P.	⅞ in.
Inside clearance	5/16 in.
Lead in full gear	3/16 in.
WHEELS.	
Driving, diameter over tires	56 in.
Driving, thickness of tires	3 in.
Driving journals, main, diameter and length	9½ x 13 in.
Driving journals, others, diameter and length	9 x 13 in.
Engine truck wheels, diameter	30 in.
Engine truck, journals	5½ x 10 in.
Trailing truck wheels, diameter	44 in.
Trailing truck, journals	7½ x 14 in.
BOILER.	
Style	Conical
Working pressure	225 lbs.
Outside diameter of first ring	83⅞ in.
Firebox, length and width	108⅛ x 96⅛ in.
Firebox plates, thickness	7/16, 9/16, ⅝ in.
Firebox, water space	F. 5 in., S. & B. 4½ in.
Tubes, number and outside diameter	401—2¼ in.
Tubes, length	24 ft.
Tubes, material	Char. Iron
Heating surface, tubes	5,646 sq. ft.
Heating surface, firebox	367 sq. ft.
Heating surface, total	6,013 sq. ft.
Grate area	72.2 sq. ft.
Smokestack, diameter	20 in.
Smokestack, height above rail	179 7/16 in.
TENDER.	
Tank	Water Bottom
Frame	13 in. Chan.
Wheels, diameter	33 in.
Journals, diameter and length	5½ x 10 in.
Water capacity	9,000 gals.
Coal capacity	15 tons

Water Tube Fire Boxes for Locomotives

THE SUCCESS OF THE BROTAN BOILER IN FOREIGN COUNTRIES, GIVING OVER 14 PER CENT. FUEL ECONOMY, HAS RESULTED IN ATTRACTING GENERAL ATTENTION TOWARD THIS FORM OF CONSTRUCTION, AND MANY INSTALLATIONS ARE BEING MADE.

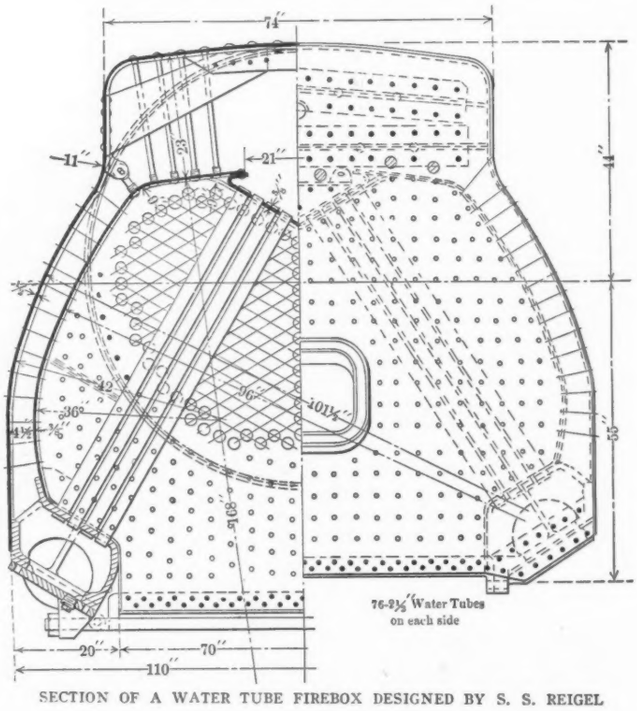
Water tube boilers, or properly water tube fireboxes, although never in receipt of much encouragement in this country, have not been an altogether unknown quantity. It is recalled that upwards of fifty years ago several engines so equipped were running regularly on the Philadelphia and Reading Ry., and it is to be regretted that through lack of proper appreciation they were quickly abandoned in favor of the much more common type which has now become standard in American practice. These early water tube fireboxes were quite similar to those which are now doing such good work in foreign countries, and had they been as painstakingly developed, there is no reason why the results should not have been equally gratifying.

This, it is believed, is the only instance of the water tube arrangement being actually put in service in America, although a number of patents have been granted on similar devices of more or less merit, none of which reached the point of attaining an actual existence. Some fifteen years ago William Forsyth, mechanical engineer of the C., B. & Q. R. R., proposed a water tube boiler of very substantial design, in fact differing only in detail from its successor of the present day. Unfortunately, this did not pass beyond the paper stage, despite its many plainly evident good features and the sound logical reasons which inspired it. The idea, however, clung with some persistency, and the years intervening since then have produced many creditable and a great many impracticable schemes, but all with the ultimate end in view to secure increased efficiency in steam production, with the minimum of complexity.

Probably the most prominent of these in the former class, and one worthy of special mention, is the water tube firebox designed and patented by S. S. Riegel, mechanical engineer of the Delaware, Lackawanna and Western R. R., in 1906,* which is herein illustrated. This was in reality a proposed re-design of a Southern Railway firebox of that period, to be secured through the substitution of a cast steel mud ring with water pockets cast in it, which ran parallel on either side with the grates. These pockets were intended to form the lower terminations for two nests of water tubes extending diagonally upward to the crown sheet, which latter was to be slightly depressed to keep the upper tube terminations flooded.

This practical idea did not pass into working form, but its economy was thoroughly demonstrated through a most interesting model test which has been described and illustrated in this journal,† and which effectually substantiated all claims the inventor had originally advanced for his patent.

Notwithstanding, however, the general apathy exhibited in this country toward this proposed change in boiler design, no deterrent influence was exerted on mechanical engineers of the old world. The versatility exhibited by these clever designers is well attested to in the patent reports of the various European



SECTION OF A WATER TUBE FIREBOX DESIGNED BY S. S. REIGEL

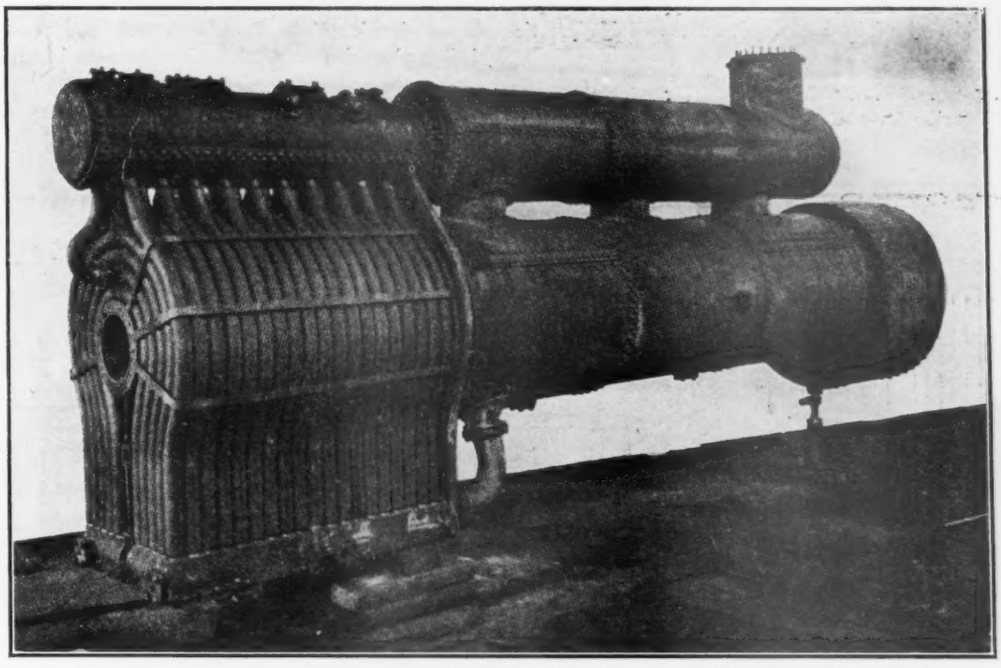
* See AMERICAN ENGINEER, April, 1906, page 136.

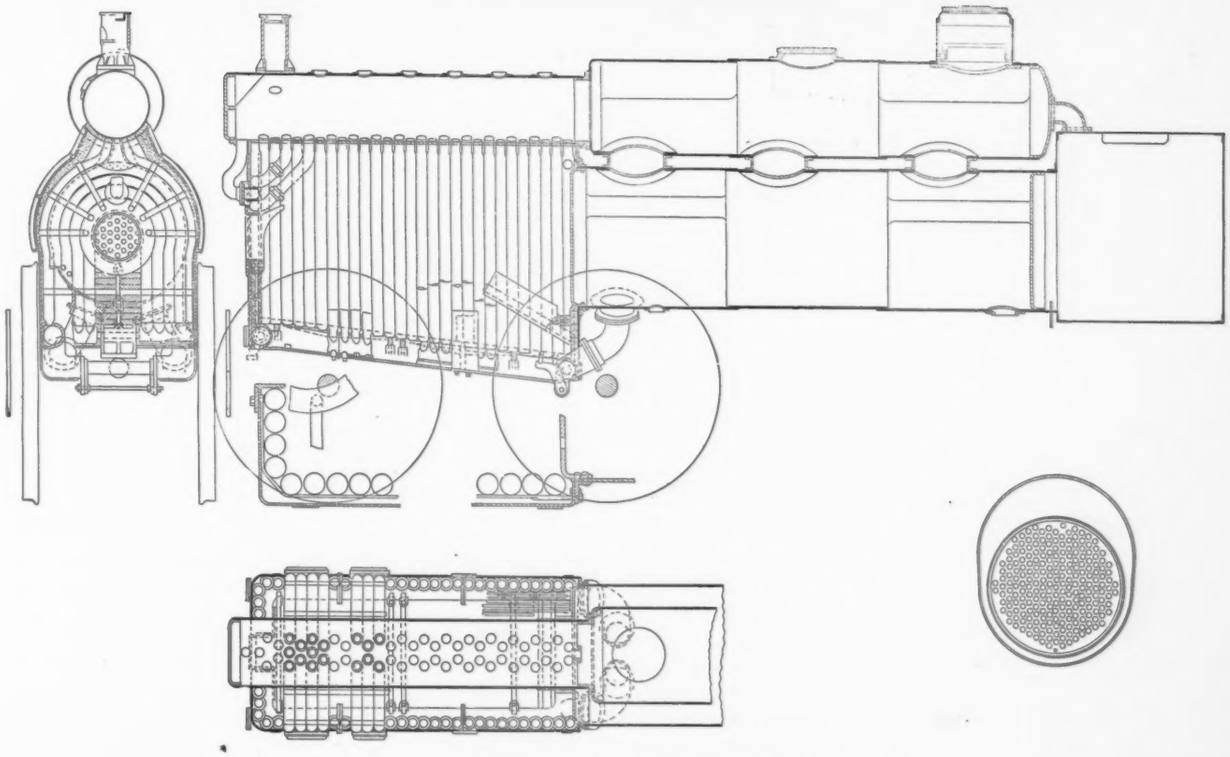
† See AMERICAN ENGINEER, June, 1909, page 253.

countries. A study of the majority of these devices carries no particular appeal, but it is an interesting fact that differing from the timidity so noticeable here, it appears that each new design was actually built and given a tryout, and this despite the fact that the greater number must appeal from a disinterested standpoint at least as utter absurdities.

Before attempting the full consideration of this now important subject it is thought best to eliminate these freak designs which were of no practical value and to confine to the type which has conclusively proved its worth under actual service conditions. From this standpoint the ground narrows to the study of a boiler with a firebox containing water tubes, and with fire tubes through the cylindrical portion, arranged in the manner with which we are familiar, or, in other words, a fire tube boiler with a water tube firebox. The Brotan boiler, therefore, which is being extensively installed in several European countries, becomes properly the subject for discussion as the most practical and efficient representative of the type.

It can no longer be disputed that certain points of superiority are prominent in this boiler which has been specified for some of the most notable engines in Europe, and particularly for the high speed service of the Prussian State and the Moscow-Kazan railroads, where it is a feature of the very latest fast express locomotives. The results, which are thoroughly authenticated

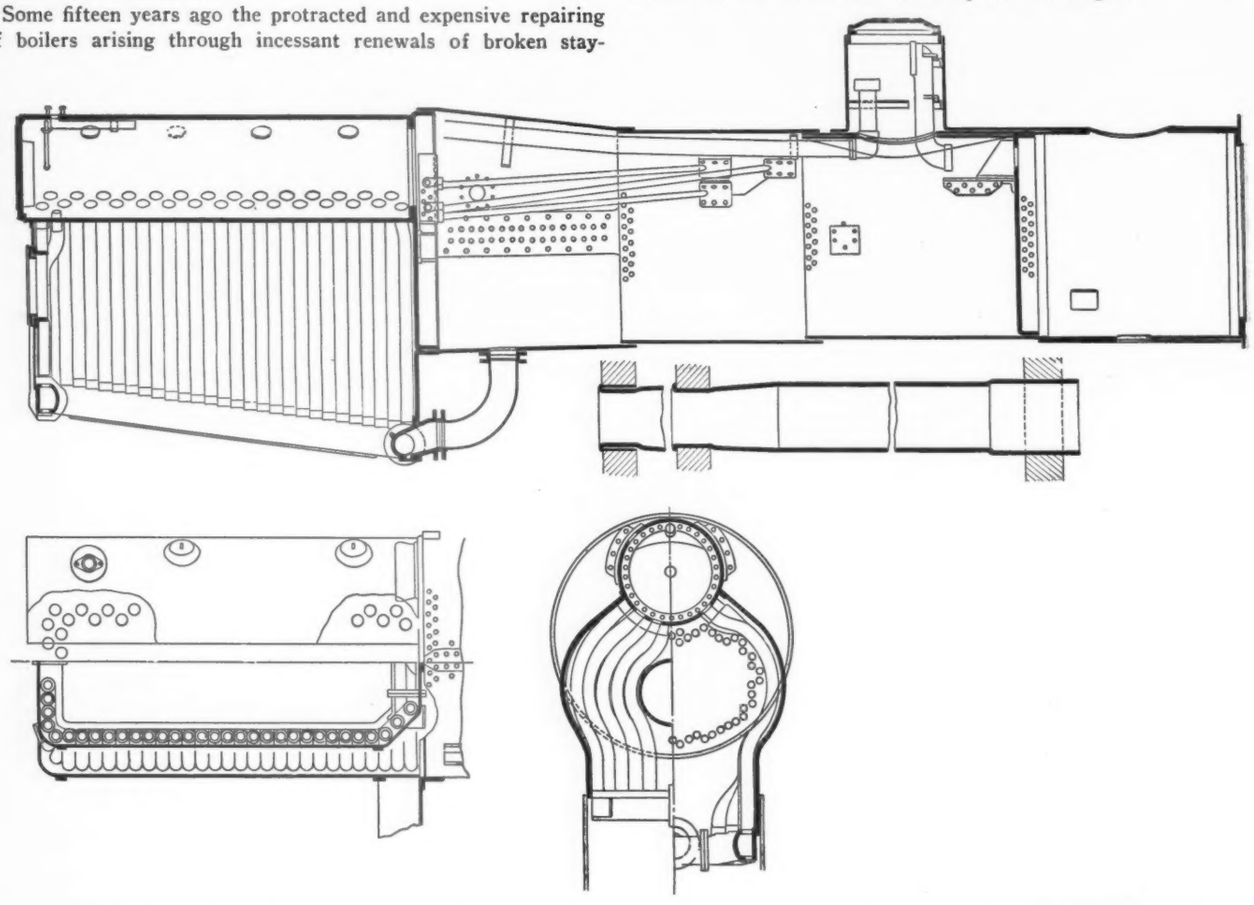




ORIGINAL BROTAN WATERTUBE BOILER

are gratifying to a degree, and the data presented is so convincing that it becomes inadvisable to avoid giving the subject serious consideration. While it may be conceded that the Brotan boiler is still in the experimental stage, it is, nevertheless, at a point where the fruits of the experiments may be profitably assumed in this country for further development. If this boiler will realize one-half the economy claimed for it by the Moscow-Kazan Ry., for instance, where repeated tests give 14.43 per cent. in coal consumption, a trial at least would appear as a logical necessity. The history of its introduction into foreign practice merits a brief mention.

Some fifteen years ago the protracted and expensive repairing of boilers arising through incessant renewals of broken stay-bolts and the impracticability of further increasing pressures through the liability of inducing further breakages were the principal features which led G. Noltein, member of the administration of the Moscow-Kazan Ry. of Russia, to consider the possibility of replacing the usual locomotive firebox by one of new type with water tubes and without staybolts. The experiments begun with this object in view, however, were not yet completed when chief inspector J. Brotan, works manager of the Austrian State Ry., brought forward his water tube firebox, which had been very carefully thought out and logically designed. This was entirely to the satisfaction of Mr. Noltein, as it made further work on his part unnecessary, and rendered it possible to proceed immediately to practical tests of a completed design which aimed at exactly the object which he had in view.



BROTAN WATERTUBE BOILER AS APPLIED TO 2-8-0 TYPE SUPERHEATER LOCOMOTIVES ON THE MOSCOW-KAZAN RAILWAY

After the protracted formalities, which in Russia obstruct the introduction of anything new had been overcome, it became possible in 1904 to begin the construction of two experimental boilers for application to 0-8-0 freight locomotives. The general arrangement of these first boilers of the Brotan type, which are still in service, although lately the type has been subject to a re-design in which the upper barrel is eliminated, is clearly shown in the accompanying illustrations.

The foundation tube, which occupies the place of the foundation or mud ring in the ordinary construction, has as its chief function that of supplying water to the firebox water tubes, in order to replace from the barrel, with which it is connected by two large tubes, the water that is evaporated in the firebox tubes. The result is a very quick circulation, and this, it is claimed, makes it more difficult for scale to deposit even if hard water is used. Having a tube from the barrel at either front corner of the foundation tube has made it possible to avoid connecting both longitudinal sides of the foundation tube. This is an appreciable improvement, as experience has shown that the flange joints of the foundation tube are those points of the boiler where it is most difficult to prevent leakages.

It will be noted that the firebox and firebox shell of the ordinary boiler have been replaced by vertical water tubes made of iron or steel, and extending from the common foundation ring to the upper drum. These tubes, which are spaced rather close, form the walls of the firebox and allow rapid circulation from the barrel to the upper drum. As the water enters the firebox water tubes from below steam rises very freely without forming vortices, and as the mixture of steam and water in the tubes has a materially lower specific gravity than the entering water, the circulation must be necessarily greatly facilitated. The quicker and more economic production of steam in the Brotan boiler can only be attributed to this feature, and to the greater direct heating surface which results from the circular cross section of the tubes and from their staggered arrangement on entering the receiver.

When the authorization was given for this construction several prominent engineers expressed misgivings that its maintenance would prove a serious problem, but in reality the cost of repairs has been less than in a boiler of ordinary design. After three years continuous service it was found that the few leaks which did develop were easy to remedy, and the only work required of any magnitude consisted in replacing one burnt water tube, which resulted from lack of care in washing out. A large number of pieces of scale had been allowed to accumulate in the foundation tube, and these obstructed the circulation in the tube

which failed. Only one day was required by the shops to make these repairs.

It has been mentioned that the economy of 14.43 per cent. in coal consumption was attained by these engines on the Moscow-Kazan Ry., a figure so surprising that the administration of that road refused to accept the report from its statistical section until it had been checked by a number of carefully executed trial runs which extended throughout the entire month of April, 1909. The results were synonymous with those originally reported on, and the administration thereupon decided to equip fifteen superheated steam passenger locomotives of the 2-8-0 type with Brotan boilers.

These differ somewhat in appearance from the original design, as shown in the drawing of the boiler. The upper drum has been eliminated, and the back ring of the boiler coned. This change, which provides a much larger water surface, and at the same time a sufficiently large steam space, has served to overcome the trouble of wet steam which was present in the former type to a certain extent. With this exception, and that the number of fire tubes has been increased from 208 to 230, the design remains the same as originally produced. The firebox has the usual arrangement of grates and brick arch, and is intended to work at a pressure of 210 pounds.

Among the locomotives with Brotan boilers on other Russian lines it is necessary to mention two 0-8-0 freight locomotives, Nos. 675 and 708, which have been running on the South Eastern Ry. since December, 1907. The design of the boilers of these locomotives is that of the original Brotan type, the only difference being that the connection between the foundation tube and the barrel of the boiler consists of one instead of two tubes, and which has a diameter of 7 15/16 in. The chief particulars of these boilers is as follows:

Working pressure	185 pounds
Tubes, number and outside diameter	208—2 in.
Tubes, length	14 ft. 7 5/16 in.
Heating surface, tubes	1,440 sq. ft.
Heating surface, firebox	163 sq. ft.
Heating surface, total	1,603 sq. ft.
Grate area	20.8 sq. ft.
Weight of boiler empty	29,000 lbs.

These two locomotives were at first used in a district where the feed water has a hardness of 13 to 17 degrees. The trains weigh about 700 tons in summer and 640 tons in winter, weight of locomotive and tender included. In November, 1908, they were transferred to another district on which conditions were less favorable, with heavier grades and feed water with a hardness of 20 to 35 degrees.

Working under these conditions the locomotives have given excellent results in every respect. That they are very economical with coal as compared with the ordinary boiler is shown by the following tabulation:

	Coal consumed in lbs.	Miles run.	Coal consumed in lbs. per locomotive mile.
Brotan boiler locomotives	3,092,360	30,271	69.12
Other locomotives	11,621,390	136,431	85.18

The saving in coal in the locomotives with Brotan boilers is accordingly:

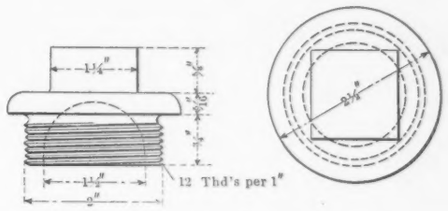
$$(85.18 - 69.12) \div 85.18 = 18.87 \text{ per cent.}$$

It should be added, however, that the administration of the South Eastern Ry. does not attribute this coal economy solely to the feature of the Brotan boiler, for the two locomotives were at the time of that installation improved in other ways. The Joy valve gear of the Russian standard 0-8-0 freight locomotives was replaced by Heusinger valve gear, and the ordinary flat slide valves by balanced slide valves of the von Borries type. The railway, on the basis of other experiments, attributes a coal economy of 9 to 10 per cent. to these alterations in design, which leave an economy of from 9 to 10 per cent. in favor of the Brotan boiler. In view of the minimum of trouble which it has experienced with this type the South Eastern Ry. will adopt the Brotan as standard in some service.

At the present time, so far as can be learned, the total number of these boilers now in service in European countries is 71, distributed throughout all classes of service, but inclining particularly toward fast passenger work, where free steaming qualities are particularly to be desired. The management of the railroads where the boiler has been tried out have no hesitation in saying that they are perfectly willing to install it as a permanent institution, but its introduction must necessarily proceed slowly in view of the fact that government approval must be secured in the majority of those countries where standards are changed on evenly privately owned roads.

GREASE LUBRICATION

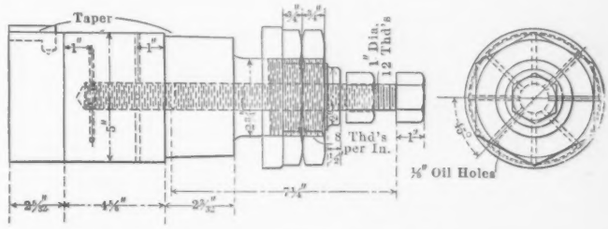
Experience with grease cups on main and side rods, on some roads, indicates that the usual screw plug for forcing the grease out of the cup is not necessary and that by using the proper lubricant the warmth of the pin itself will cause sufficient lubrication. This not only is a great saving in the amount of grease used, but also simplifies the construction of the cup itself and makes it decidedly less expensive. On the back end of main rods, however, the centrifugal action makes it very difficult to



CAP FOR GREASE CUP ON MAIN AND SIDE RODS

keep even a simple cap on the grease cup and considerable annoyance has been caused by these caps constantly being lost, which not only is an expense, even if they are made of malleable or cast iron, but also gives an opportunity for cinders and dirt to get to the pin.

A cap has been designed in the mechanical engineer's office of the Atchison, Topeka & Santa Fe Railway which has proven a decided success in this regard, probably due to the size of the collar that bears on top of the cup and the depth of the thread. It will be noticed in the illustration that this cap is hollowed out in the centre and when it is applied, after a new filling of the



CROSSHEAD PIN ARRANGED TO USE GREASE LUBRICATION

cup, it forces sufficient grease on to the pin to thoroughly lubricate it ot the start.

In the same office a grease lubricator for cross head pins has also been designed. This, as will be seen in the illustration, consists of a hole in the centre of a pin threaded to receive a 1 in. bolt. From this four ⅛ in. holes lead to the bearing surface, as shown. Grease in suitable shape is inserted in the hole and the bolt used for a plunger in the customary manner. While this construction is not suitable for the inside cross heads of four-cylinder locomotives, it offers no obstruction in outside cylinders. With Walschaert valve gear the relative position of the cross head pin and combination lever is such that they never interfere.

GRAND TRUNK PACIFIC TO REACH COAST IN 1913.—After completing his inspection of the Grand Trunk Pacific to the end of its track, 200 miles west of Ebenton, E. J. Chamberlain, vice-president and general manager of that road, has expressed an opinion that through train service would be established from Bonaventure to the Rocky Mountains by 1912, and a year later to the Pacific Coast.

REVISED SPECIFICATIONS FOR STAYBOLT IRON

At the recent convention of the American Society for Testing Materials the Committee on Standard Specifications submitted a revised specification for staybolt iron, which under the rules goes over for one year. The changes consist of the following: The addition to the first sentence of the words, "the basis of which must be pig metal and entirely free from any admixture of steel"; and the omission of the following matter: "the pile must be made up of a central core composed of bars from ½ inch to 1 inch square, and be covered on all four sides with an envelope ⅝ inch thick, as per sketch. This pile must be rolled to a billet, allowed to cool, again heated and then rolled into bars of the required dimensions." The proposed changes also include the substitution of a nick and bend test for the threading test.

The revised specification is as follows:

PROPOSED STANDARD SPECIFICATIONS FOR STAYBOLT IRON.

Process of Manufacture.

All staybolt iron must be hammered or rolled from a bloom or a box-pile having a cross-sectional area of at least 45 sq. in., and not less than 18 in. long, the basis of which must be pig metal and entirely free from any admixture of steel.

Physical Tests.

(*a*) Tensile Strength.—Not less than 48,000 lb. per square inch.

(*b*) Elongation.—Not less than 28 per cent. in 8 in.

(*c*) Reduction of Area.—Not less than 45 per cent.

(*d*) Double Bending Test.—Close in both directions without flaws.

(*e*) Nick and Break Test.—A bar, nicked all around to a depth not less than 8 per cent. and not more than 16 per cent. of the diameter of the bar, and broken, shall show a clean fiber entirely free from crystallization.

(*f*) Vibration Test.—The test bar shall stand a minimum of 6,000 revolutions when subjected to the following vibratory test:

A threaded specimen, fixed at one end, has the other end moved in a circular path while stressed with a tensile load of 4,000 lb. The circle described shall have a radius of 3-32 in. at a point 8 in. from the fixed end of the specimen.

Inspection.

(*a*) The iron must be smoothly rolled and free from slivers, depressions, seams, crop ends and evidences of being burnt.

(*b*) It must be truly round within 0.01 in. and must not be more than 0.005 in. above or more than 0.01 in. below specified sizes.

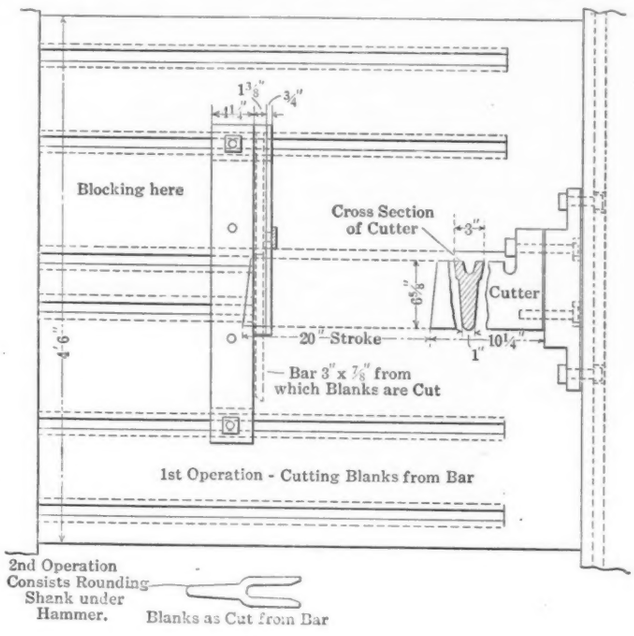
Selection of Samples for Test.

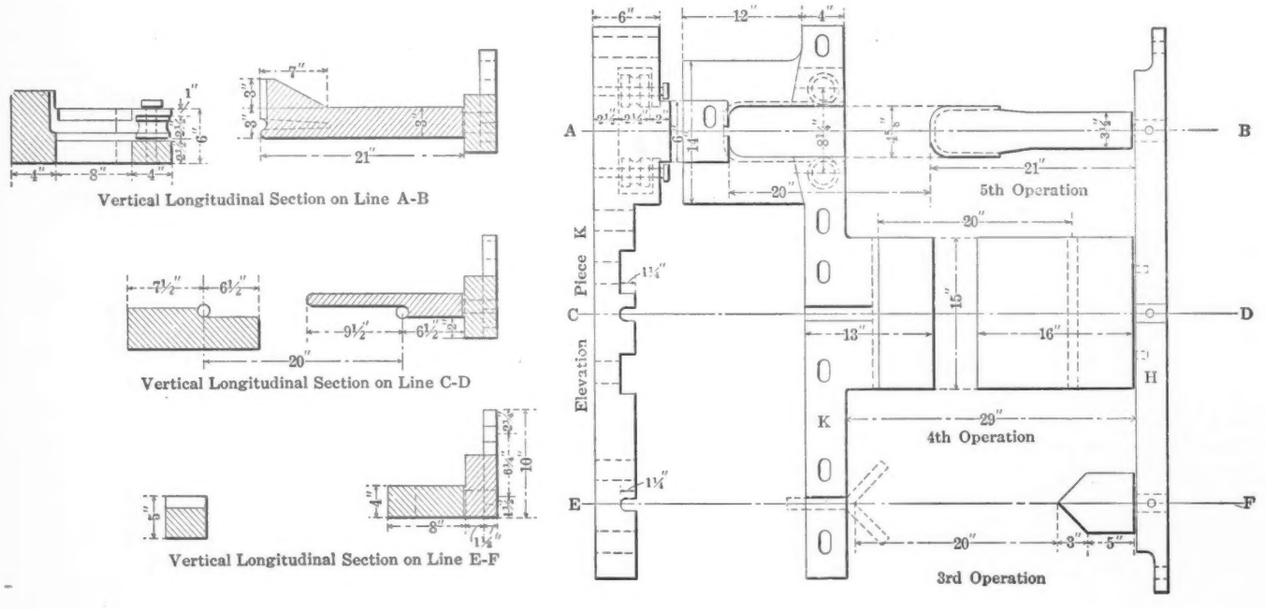
The bars will be sorted into lots of 100 bars each and two bars will be selected at random from each pile. Failure of either of these bars to meet any of the above specifications will be cause for rejection of the lot which the tests represent.

MAKING FIRE HOOKS ON A BULLDOZER.

GEO. H. ROBERTS.

At the Readville shops of the New York, New Haven and Hartford R. R. formers have been designed for making two-



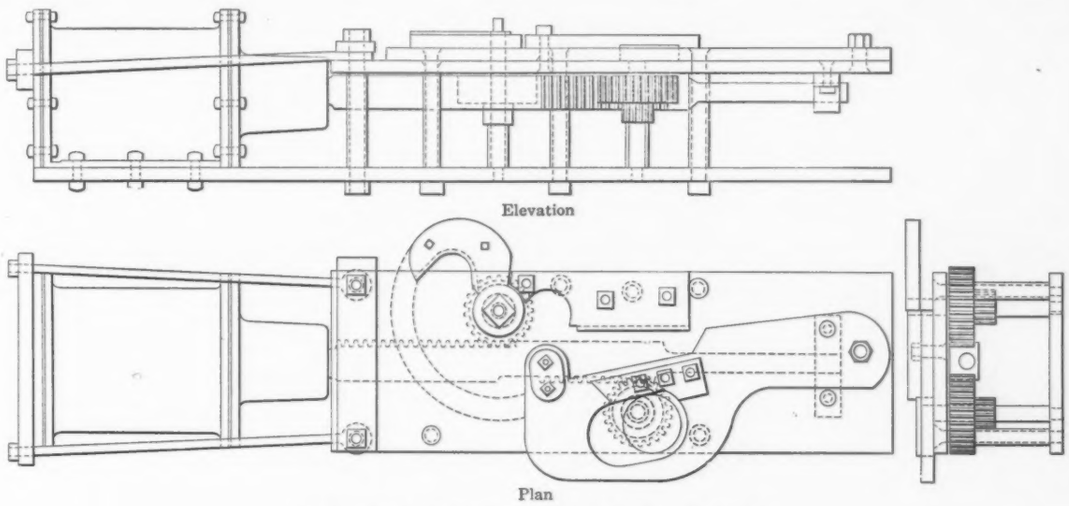


FORMERS AND ARRANGEMENT FOR THE FIVE OPERATIONS IN MAKING THE PRONGS ON FIRE HOOKS

pronged fire hooks on the bulldozer which will turn out 500 hooks in nine hours, two men working, and 200 handles per hour, two men working. Welding the hooks on the handles is done separately.

The formers used are shown in the illustrations. But one operation is required for making the handles, a very ingenious use of rack operating gears and an eccentric cam to give the proper movement to suitably shaped heads employed. The rack is connected to the piston of a 10-inch air cylinder. The movement of the formers will be evident from a study of the illustration.

Five operations are required in making the hooks. They are all done with but two heats, however. The first operation consists of punching blanks of the shape shown out of ⅞ x 3-inch stock. It will be seen that there is very little waste of material in this operation. The shank of the blank is rounded under a hammer during the same heat, this being the second operation. The piece is then reheated and the third operation consists of spreading the jaws apart as shown by the dotted lines. It is then transferred to the next set of dies where it is formed into T shape and the prongs rounded at the proper taper. The fifth and last operation consists of bending the prongs to the shape shown in the end view of the hook and at right angles with the shank. The last three operations are performed on one machine and with one heat.



FORMERS FOR BENDING THE HANDLE OF FIRE HOOKS

SIXTY MILLION DOLLARS EXPENDED FOR CROSSTIES IN 1909

The Census Bureau, in conjunction with the Forest Service of the Department of Agriculture, annually collects and publishes a special report relative to the consumption of cross-ties. This information has just appeared in a preliminary comparative report covering 1909, 1908 and 1907, and it indicates an enormous increase, fully 10 per cent., in the number of wooden cross-ties purchased for consumption by the steam and electric railroads in the United States in the calendar year 1909, as compared with the number purchased in 1908.

In 1909 the total number of cross-ties of all kinds of wood, reported as having been purchased, was 123,754,000, costing $60,321,000 at the point of purchase, as compared with 112,463,000, costing $56,281,000, in 1908, and 153,700,000, costing $78,959,000, in 1907. The latter year does not, however, represent the true standard of comparison, as it was one of unusual railroad development. The decrease in 1908 was about 26.8 per cent., but in 1909 the balance swung back to 80.5 per cent. of the 1907 record, and was, as stated, an increase of about 10 per cent. over 1908.

A significant feature is the fact that in 1909 there were 16,437,000 cross-ties reported as purchased for new tracks, against 7,431,000 in 1908, and 23,557,000 in 1907. The amount expended for ties by the steam and electric railroads in 1909 amounted to $60,000,000. The purchases by steam railroads formed about 93 per cent. of the total in 1909 as compared with approximately 94 per cent. in both 1908 and 1907. While there was considerable variation in the number of cross-ties purchased during the three years, the average cost per tie remained close to 50 cents.

THE ALL-IMPORTANT ROUNDHOUSE.—There are about 60,000 locomotives in the United States and their cost of maintenance is approximately $2,500 each per year, or a total for all of $150,000,000. About one-half of this work, amounting to $75,000,0000 is done in the roundhouse. In addition to this running repair work the roundhouse organization is required to perform such service work as may be necessary, including the movement of engines, the washing of boilers and tanks, the cleaning of flues, firing up, and coaling, sanding and watering, etc. The cost of this service varies between wide limits, and averages something over $1.50 per engine, or approximately $500 a year for each engine owned. This adds about $30,000,000 to the amount expended in roundhouses and makes a total of $105,000,000.—*F. H. Clark, at the University of Illinois.*

NOT FAVORABLE TO MAIN LINE ELECTRIFICATION.—The case of entirely new railways is much more favorable to electrical operation. In laying out a new branch to an existing railway, it may be well worth while to consider electrical operation, the capital cost of which might be more than saved in the cheaper roadbed, since steep grades are much less objectionable on an electrical than on a steam road. Of course, there are likely openings for local electrification on existing railways even apart from suburban systems. It might, for instance, be found profitable to work the pushers on the inclines electrically. It is quite possible, again, that where electric power is already available at goods yards and docks, the shunting could be more efficiently carried out by specially designed electric locomotives, fed perhaps by a suitable surface-contact system, than by steam locomotives, that would seem to be uneconomical for such work. For ordinary main-line work, however, there is at present no indication that the steam locomotive can be superseded with advantage in this country.—*W. F. W. Carter, of Rugby, England, before the Institution of Mechanical Engineers.*

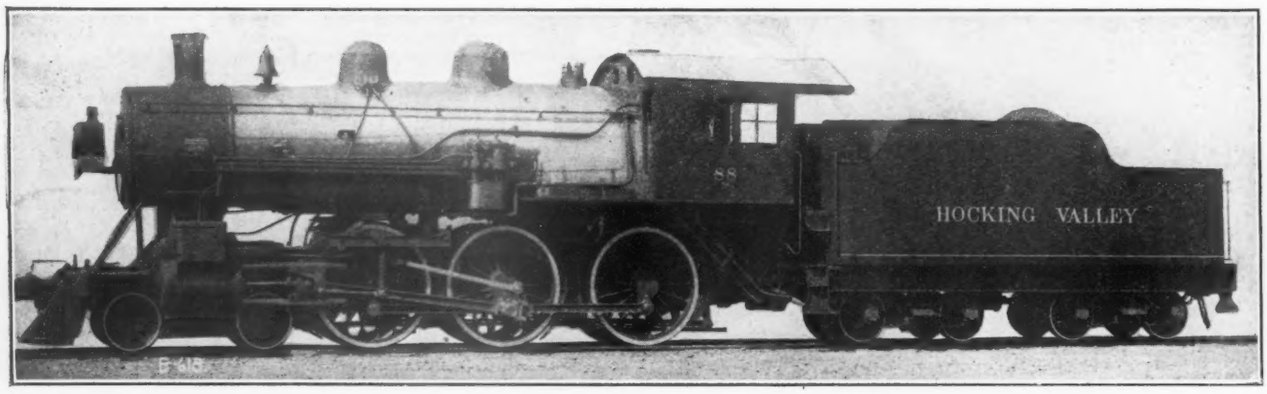
A NEW USE FOR ELECTRIC WELDING is described in the engineering supplement of the London *Times* of September 14, 1910. A steel chimney 56 ft. high and 4 ft. 3 in. in diameter, was put together entirely by electric welding, and was completed before erection. It was erected in about three hours.

Heavy Power for the Hocking Valley Ry.

A RECOGNITION OF THE VALUE PERTAINING TO THE OPERATION OF HEAVY TRAIN UNITS HAS BEEN ACCORDED BY THIS COMPANY IN SUPERSEDING ITS FORMER LOCOMOTIVES WITH OTHERS OF PRACTICALLY DOUBLE CAPACITY

With a view to ultimately replacing its light power, in both freight and passenger service, the Hocking Valley Ry. has recently received twenty freight and three passenger engines from the American Locomotive Company. These were designed by the late G. J. DeVilbiss, superintendent of motive power of that line, and represent many departures from the former practices of this road.

For instance, the heaviest freight type heretofore used has

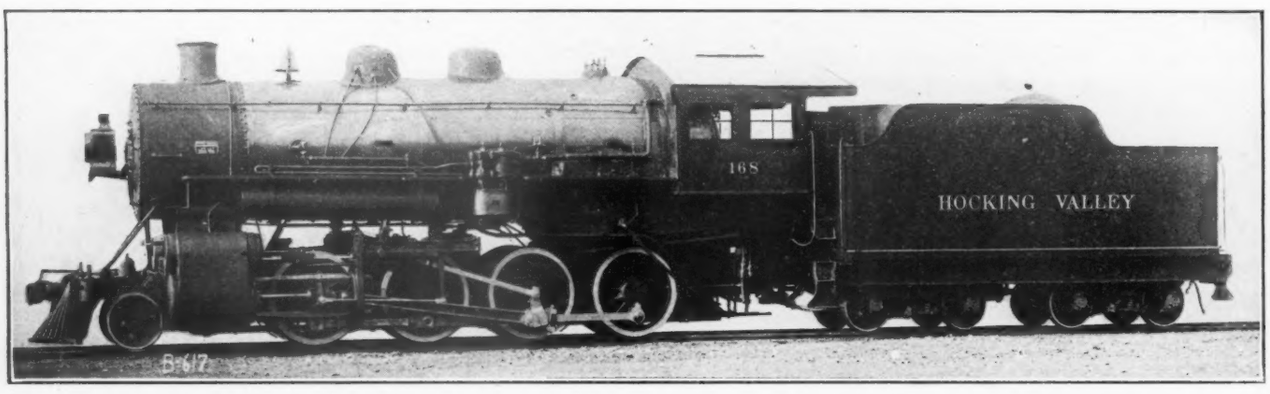


NEW TEN WHEEL LOCOMOTIVE FOR THE HOCKING VALLEY RY.

total weight of 164,000 lbs., with 20 x 26 in. cylinders, 180 lbs. steam pressure, 54 in. drivers, maximum tractive effort, 29,400 lbs., and hauling capacity 2,400 tons. The new engines weigh 236,000 lbs., with 23 by 30 in. cylinders, 205 lbs. steam pressure, 57 in. drivers, and a maximum tractive effort of 48,500 lbs. They are capable of hauling 4,800 tons over .3 per cent. grades. The same considerable difference is noticeable in the passenger engines, which are of the 4-6-0 type, and of heavy design to handle 6 to 10 cars on a fast schedule, with stop averaging five miles apart. They weigh 188,000 lbs., with 20 by 26 in. cylinders, 200 lbs. boiler pressure, 72 in. drivers, and maximum tractive power of 24,500 lbs., as against the previous largest passenger engines weighing 141,000 lbs., with 18 by 26 in. cylinders, 180 lbs. pressure, 66 in. drivers, and 19,500 tractive power.

The boilers of both types are radial stayed extended wagon top, a departure from the Belpaire, which has heretofore been standard on that line. Tube heating surface has been somewhat sacrificed in square spacing, but there is a large amount of fire-box surface, especially in the passenger engines. Flexible stay-bolts have been used to a large extent. The fire doors are pneumatic, and ash-pans are Hocking Valley standard drop bottom, which have been adopted by several leading railroads.

All of the engines are equipped with Baker-Pilliod valve gear the passenger engines and ten freight engines having slide valves and the other ten with piston valves. The frames on the freight engines are Vanadium cast steel, and the driving springs on both engines are of the same material. The shoes and wedges are of bronze working on cast steel boxes. All cylinders are bushed with gun iron, and the pistons of the solid-head type have gun iron packing rings. The tenders have tanks of the water bottom type, set on steel trusses of 13 in. channels, and the trucks are of the arch bar type, with cast steel bolsters and cast steel wheels.



NEW, POWERFUL CONSOLIDATION LOCOMOTIVE FOR THE HOCKING VALLEY RY.

As indicated in the accompanying illustrations the engines, particularly the freight type, are of a strikingly handsome and compact design. The general dimensions and ratios are as follows:

GENERAL DATA.

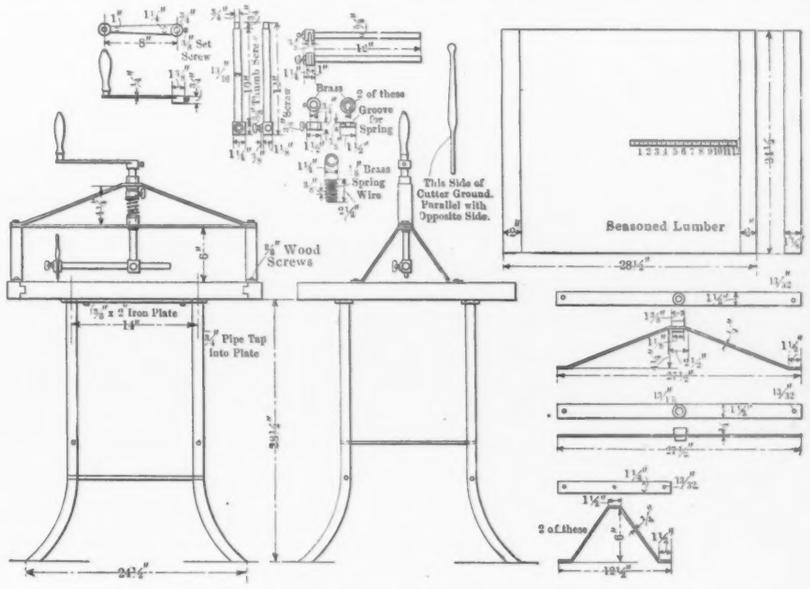
	Freight	Passenger
Tractive effort	48,500 lbs.	24,500 lbs.
Weight in working order	236,000 lbs.	188,650 lbs.
Weight on drivers	208,000 lbs.	142,000 lbs.
Weight of engine and tender in working order	390,000 lbs.	332,000 lbs.
Wheel base, driving	17 ft. 3 in.	14 ft. 4 in.
Wheel base, total	26 ft. 5 in.	26 ft. 1 in.
Wheel base, engine and tender	58 ft. 3 in.	56 ft. 6 in.
RATIOS.		
Weight on drivers ÷ tractive effort	4.29	5.79

Total weight ÷ tractive effort....4.87	7.67
Tractive effort × diam. drivers ÷ heating surface..783.14	707.01
Total heating surface ÷ gate area....64.18	47,98
Firebox heating surface ÷ total heating surface, %...5.72	6.81
Weight on drivers ÷ total heating surface....58.92	56.91
Total weight ÷ total heating surface....66.86	75.35
Volume both cylinders, cu. ft....14.42	9.45
Total heating surface ÷ volume cylinders....244.80	264.02
Grate area ÷ volume cylinders....3.81	5.50
CYLINDERS.	
Kind ....Simple	Simple
Diameter and stroke....23 by 30 in.	20 by 26 in.
VALVES.	
Kind, on ten engines....14-in. piston	
Kind, on others....Slide	Slide
Greatest travel, piston....5 in.	
Greatest travel, slide....5¼ in.	5¾ in.
Outside lap ....1 in.	1 in.
Inside clearance ....Line and line	1/16 in.
WHEELS.	
Driving, diameter over tires....57 in.	72 in.
Driving, diameter centers....50 in.	66 in.
Driving journals, main, diameter and length...10½ x 12	9 x 12
Driving journals, others, diameter and length....10 x 12	9 x 12
Engine truck wheels, kind....Cast steel	Cast steel
Engine truck wheels, diameter....33 in.	33 in.
Engine truck journals, diam. and length....6 x 12	5½ x 12
BOILER.	
Type ....E. W. T.	E. W. T.
Working pressure ....205 lbs.	200 lbs.
Outside diameter first ring....80 in.	67 in.
Firebox, length and width....73¾ x 108⅛	73¼ x 102¼
Firebox, thickness of plates....⅜ and ½	⅜ and ½
Firebox, water space ....5 in.	5 in.
Tubes, number and outside diameter....412—2 in.	291—2 in.
Tubes, length ....15 ft. 6 in.	15 ft. 4 in.
Heating surface, tubes....3,328 sq. ft.	2,325 sq. ft.
Heating surface, firebox....202 sq. ft.	170 sq. ft.
Heating surface, total ....3,530 sq. ft.	2,495 sq. ft.
Grate area ....55 sq. ft.	52 sq. ft.
TENDER.	
Tank, type ....Water Btm.	Water Btm.
Frame ....13-in. channels	13 in. channels
Wheels, diameter ....33 in.	33 in.
Wheels, kind ....Cast steel	Cast steel
Journals, diameter and length....5½ x 10	5½ x 10
Water capacity ....7,500 gals.	7,000 gals.
Coal capacity ....16 tons	13 tons

AN EFFICIENT HOME-MADE GLASS CUTTER

The comparatively simple matter of cutting a new headlight glass becomes quite frequently a very perplexing operation, especially when it is an emergency or rush job, and no special devices exist for the purpose. It is not at all uncommon under such conditions to see a dozen plates wasted in crude attempts to secure the necessary circular shape, and with little assurance that it will fit when finally produced. It is to dismiss these unpleasant features that the Chicago and North Western Ry. has designed a very cheap and efficient circular glass cutter, which is now in successful use in its various shops.

The simplicity of the device is clearly indicated in the accompanying drawing. The frame, or base, is made from ¾ in. pipe, on the top of which is fastened a board, scaled in inches, and which allows the cutter to be set at the required radius. A common ten cent cutter is used, held in place by a set screw. The coil spring is intended to hold the cutter up from the board to admit the work. This very handy little cutter will take care of circular glass from one inch to the largest headlight size of 24 inches in diameter.



HOME-MADE GLASS CUTTER

GETTING SUGGESTIONS FROM THE MEN

The American Locomotive Company is experimenting in its Rogers works at Paterson, N. J., with the plan of paying weekly prizes to its employees for the best suggestions tending toward improvement in existing shop methods. This innovation has awakened the liveliest interest among the men, and since its introduction there has been no lack of competitors. The idea is particularly appealing to those who feel that they know of a good thing, and who ordinarily would have no other way to present it than by dropping the idea into the suggestion box.

While, as might be expected, some of the descriptions and sketches submitted have been found to be crude and poorly executed, practically no consideration is accorded this feature by the judges in awarding the prizes; what is wanted is a new, practical idea, and the intention is to develop all such which appear to be of value.

NEW BUILDING AT PURDUE UNIVERSITY.—On November 12 new buildings for the department of practical mechanics at Purdue University were dedicated. The main building occupies about 25,000 sq. ft. of floor space and will accommodate 400 students at one time for drawing instruction, and in addition the shops, covering 43,000 sq. ft. of ground, will accommodate 350 students. There are also class rooms, lecture rooms, offices, a museum, etc. This constitutes what is to be the largest and most complete equipment for the instruction of students in shop practices and drawing in this country. The tools and other equipment in the shop are modern in every way and many unique and special features have been installed.

THE RECORDS OF 80 ENGINES on the Great Western R. R. of England, fitted with the "Swindon" superheater, for the five summer months ended 10th of September, show an all-around saving of coal of 12½ per cent. and from 25 to 30 per cent. of water.